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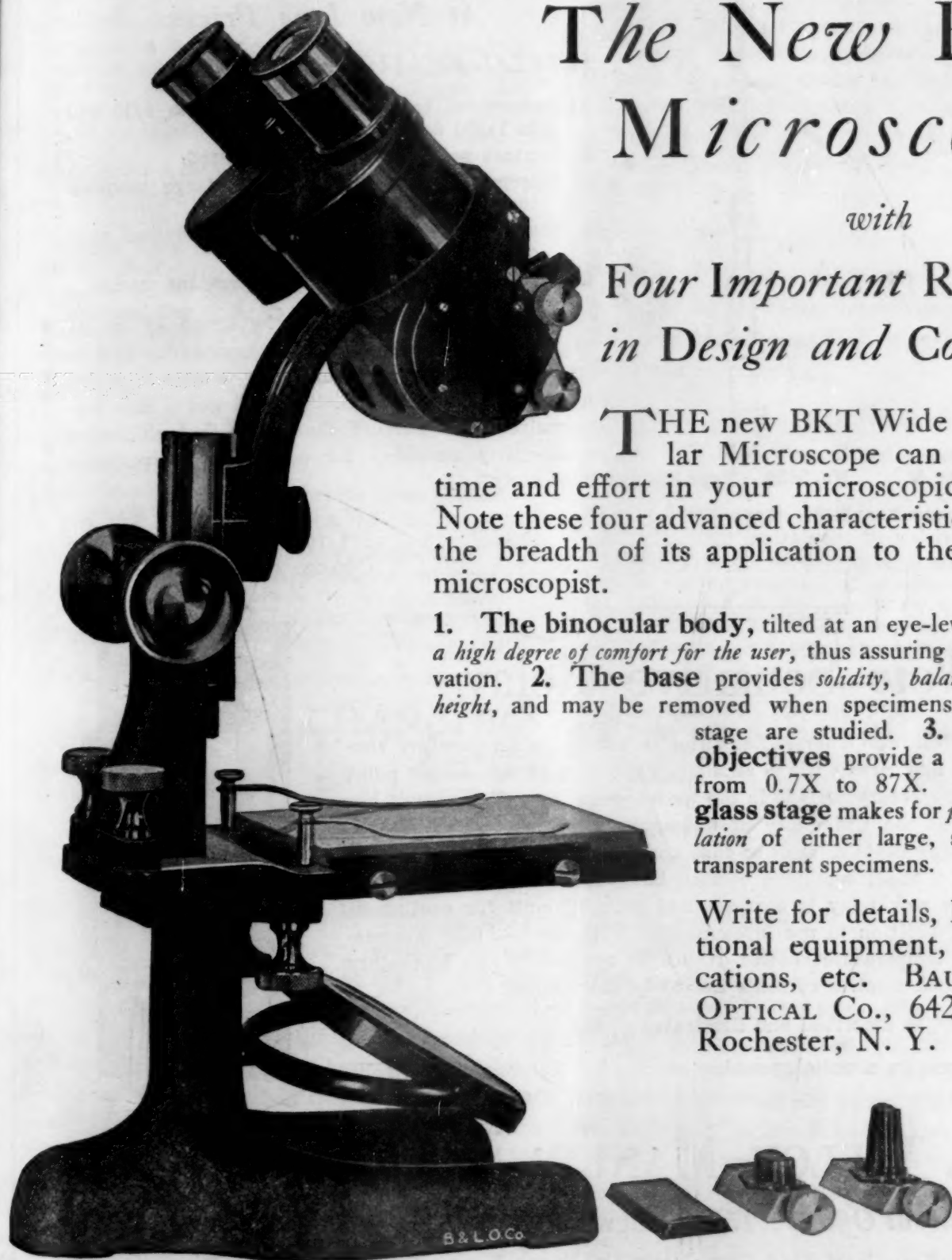
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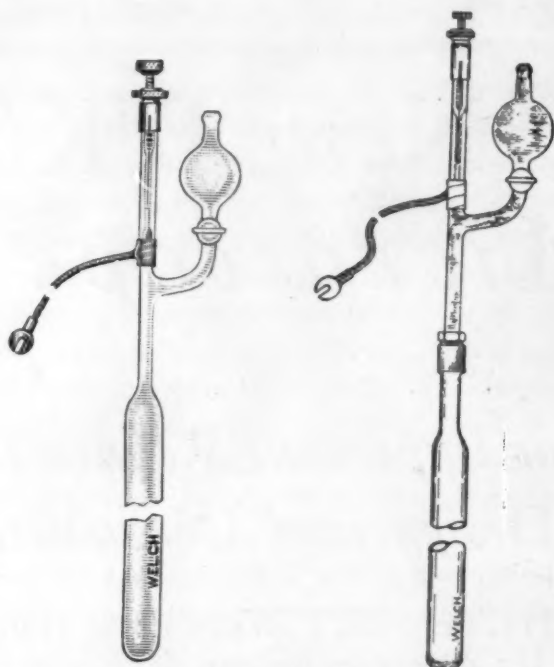


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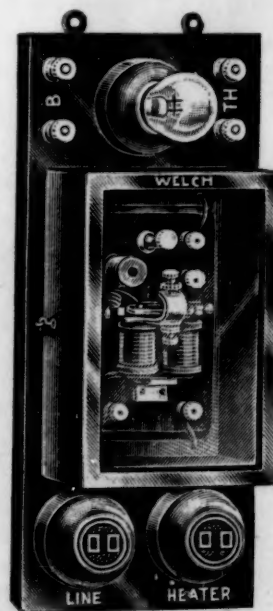
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THE CHANGING EFFECTS OF RACE COMPETITION¹

By Professor S. J. HOLMES
UNIVERSITY OF CALIFORNIA

THIS evening I shall invite your attention to certain aspects of the contemporary evolution of our own species. In so doing I am sure that I need make no apology, especially since our society, through its traditions, is concerned with the general problems of organic evolution. Most of my hearers will doubtless recall the well-known address delivered by Professor Thomas H. Huxley on "The Struggle for Existence in Human Society." In venturing to discuss some aspects of this same subject I can not hope to emulate the clear and forcible presentation of this master of scientific exposition. Human rivalry takes on different forms as the years go on, and it is chiefly for this reason that I have chosen my present theme.

Man, like all other forms of life, is subject to the

struggle for existence. He is exposed to the action of the various selective agencies which operate elsewhere in the organic world. Although selection acts upon all organisms, the way in which it acts, and whether it causes advancement, degeneration or mere lateral divergence, depends upon the peculiar circumstances under which an organism lives. The study of the influence of the selective agencies operating in the human species involves one in many complex problems. In man evolutionary changes are taking place with extraordinary rapidity. Probably nowhere else in the organic world is there a species which is undergoing such wide-spread and extensive modifications. Man is not only characterized by a degree of hereditary variability scarcely equaled by any other form of life, but he is subject to the operation of selective forces whose incidence varies greatly from place to

¹ Address of the president of the American Society of Naturalists, New Orleans, December 31, 1931.

place and from time to time. If we would understand the way in which the inherent qualities of human beings are being changed, for change they must, we must gain some insight into the action of the selective forces which determine what types of human beings have the greatest net rate of natural increase.

We are accustomed to look upon the struggle for existence as taking place according to a very simple formula. Organisms compete with one another; on the whole, the strongest, toughest or most intelligent survive and transmit their better adapted variations; and so the species comes slowly to be better fitted to its conditions of life. All this is very natural and obvious. But especially among us humans, matters do not work out so simply. Human survival and increase are conditioned by many factors which are not ordinarily included in our concept of the struggle for existence. The kind of human beings which tend to prevail may, for instance, be determined in part by religion and many other phenomena of our social inheritance. Social forces determine to a large extent how biological forces act, and as these social forces vary so greatly with time and place, the biological evolution of man comes to be influenced by a variety of factors which are non-existent in animals below man.

In considering the workings of selective survival in man we should distinguish between the operation of selection within groups from the operation of selection between groups. Both kinds of selection are actively working among human beings. The contention of many writers that natural selection has been practically done away with through the arts of saving life is, I am convinced, quite unjustified, and I have elsewhere defended the view that under present conditions of civilization natural selection is in several ways working more actively than ever before. However, although I may be alone in this opinion, I shall not defend it here, since my chief concern at present is with a somewhat different aspect of the problem.

Organized societies of animals behave as units in the struggle for existence. One group may drive out or exterminate another. We may therefore look upon evolutionary advance as resulting partly from improvements within each group and partly from the successive replacements of inferior by superior groups. The important rôle of group selection in man seems to have been first emphasized by Mr. Walter Bagehot in his original volume entitled "Physics and Politics," although the general doctrine had been stated by Darwin in his attempt to explain the genesis of the instincts of the hive bee. The concept of group selection came as a welcome adjunct to the theory of natural selection in its original form, because it sup-

plied a plausible explanation of the genesis of many traits which could not be accounted for simply by the preservation of variations useful only to their possessors. The employment of the idea of group selection to explain the development of mutual aid, social sympathy, self-sacrifice and the various social and domestic instincts which make for effective cooperation is, of course, familiar to all students of evolutionary theory. The idea has bulked large in the writings of the so-called Social Darwinists. It has figured prominently in the literature of evolutionary ethics, and now and then it is given some consideration by the historians. Group selection in man is seen in its clearest form in the conquest and extirpation of one tribe by another. It is vividly illustrated in the wars of extermination waged by the Children of Israel against the unfortunate tribes who were not in the good graces of Jehovah. In this conflict of tribe with tribe which has gone on throughout untold ages we may assume that groups whose members were more intelligent, cooperative and willing to make sacrifices for the common welfare were, on the whole, successful. But intertribal struggles, to have evolutionary significance, must lead to replacement of the vanquished by their victorious competitors. The extent to which the replacement of stocks actually results from intertribal conflict varies greatly with the development of culture. Frequently the biological advantages of victory are partly nullified through the mingling of the blood of the victors and vanquished. With the advance of civilization humanitarian considerations commonly prevent the extermination of unsuccessful contestants. Where, however, conflicts occur between peoples on very different cultural levels, victory often affords an opportunity for the expansion of the more advanced group. The Anglo-Saxons have achieved remarkable biological success as a result of their conquest of more primitive peoples whom they found to be in the way. The proponent of the biological value of war can find good support for his thesis in the military career of this enterprising people. Many of the defenders of war on biological grounds are prepared to concede that the effects of military selection in removing the physically best of the male population are on the whole dysgenic, but they claim that the replacement of inferior by superior groups more than compensates for this influence. In wars between modern civilized states this replacement does not usually occur. The effects of victory are economic and political rather than biological, and the vanquished are as apt as not to increase more rapidly than their conquerors. It would puzzle one to discover any great biological advantage resulting from most European wars. People do not wage wars to promote the biological advancement of their species. They behave as if they

were pawns in a game, blindly following the impulses of greed, ambition and collective pugnacity. Racial advancement may be Nature's aim, but it is not man's.

If conflict has played an important rôle in the evolution of the human species, it seems apparent that at present it has mainly outlived its biological usefulness. This does not imply that group selection is no longer operative. The racial replacement that goes on in a peaceful and generally unobtrusive manner has probably been for a long time a more potent factor in human evolution than the more spectacular but less frequent occurrence of conflict. Throughout the organic world natural selection generally works in a quiet and decorous way. Where two stocks occupy a common territory one inevitably tends to supplant the other, even though they live in most peaceful relations. The extent to which they compete as groups, however, instead of as individuals is subject to much variability. Theoretically, one may readily distinguish between individual selection, which preserves the fittest organism, from group selection, which leads to the survival of the fittest group. These two forms of selection tend to develop quite different characteristics, the one enhancing those which conduce to the preservation of the individual, the other developing characteristics making for race or group preservation, and sometimes even leading to the sacrifice of the individual life. The instincts which impel the warrior ant or termite to sacrifice itself in the defense of the colony could never have been developed by selection acting upon the individual alone. In individual selection survival depends upon the organism's own characteristics; in group selection it may depend upon the characteristics of other members of the organized society. Whether or not a queen bee survives may depend not directly upon her own peculiarities, but upon the behavior of the workers, and whether or not the workers survive may depend upon the peculiarities of the queen.

In our human relationships our chances of survival hinge in many ways upon the reactions of our fellows, but the relations of individual selection and group selection are nevertheless frequently obscure. In the first place, a human being may belong to a number of different groups at the same time. He may be a Democrat, a Baptist, an Odd Fellow and a member of the carpenters' union, and in these several capacities he will be associated with quite different individuals. To a certain extent his relation to these bodies may affect his chances of survival, his choice in marriage and the number and quality of his children. These several organizations are not, it is true, natural groups, such as the societies of ants and termites or even primitive clans of man. Nevertheless, they count for something in shaping the biologi-

cal evolution of the human species. A religious sect, for instance, which attracts a certain type of adherent and instills the virtue of fecundity, may function more or less as a unit in competing with other sects and may in time have an appreciable effect upon the hereditary composition of the population. The effort to disentangle the relations of group selection and individual selection in the complex interrelationships of human society brings us into contact with many baffling problems. As a matter of fact, the struggle between different racial stocks that goes on in the peaceful concourse of social groups eventuates in neither form of selection to the exclusion of the other. In their relations to mortality and fecundity, as in many other affairs of life, people function partly in their individual capacities and partly as members of the groups to which they belong. Group membership itself is subject to frequent changes. The rivals of one period may become the allies of the next, a fact which has a profound influence upon the biological effects of racial contacts. How important this influence is may perhaps be better appreciated after we consider briefly how racial contacts are working out in various parts of the globe.

For many years following the first advent of the white man the native Polynesian and Melanesian peoples of the Pacific have shown a striking decrease in numbers. Up to within the last few years various writers have predicted the complete extinction of the native inhabitants of many islands of the Pacific area within a relatively few decades. The Tasmanians are completely gone; the inhabitants of other islands have been reduced to a small and dwindling number, the native Australians, according to the best estimates, have decreased in numbers in face of the advance of the whites. The white man has proven a deadly scourge to many peoples with whom he has come into contact. His epidemic diseases, such as tuberculosis, measles and smallpox, have decimated the ranks of several primitive peoples. His dissemination of venereal infections has seriously checked rates of natural increase. His alcoholism and other vices have contributed to his destructive influence, and his ruthless exploitation of labor and the disturbance of the sex ratio through the transportation of workers have often proven a potent factor in causing native peoples to decrease in numbers. Whenever the white race first comes into contact with primitive peoples its biological influence is usually bad. This fact is well illustrated in the contacts of Indians and whites in the history of our own country. The whites desired the lands possessed by the Indians. The Indians for the most part could not be made to work for the whites. While some trading went on to the advantage of both parties, the whites and Indians were

essentially antagonistic groups, and often engaged in wars, which resulted in the replacement of the Indians by the conquering race. To a large extent the American Indian has remained outside the social organization of the whites, a member of an alien and essentially hostile group. To an even greater extent this alien status has characterized the native blacks of Australia, who have been on much the same basis as the other members of the mammalian fauna.

The issues of the contact of whites with such peoples as the American Indian and the native Australian afford a typical illustration of the working of group selection. Each group keeps largely to itself. Within each group the members aid one another in various ways, but there is little solicitude for the welfare of individuals who are outside the fold. Each group operates more or less as a whole in competition with others. As a result of competition, if not actual conflict, the group which is more advanced in culture, whether or not this implies a superior heredity, tends to prevail over and replace the less fortunate group. For the last few centuries the white race has been extraordinarily successful in the struggle for supremacy and expansion, and many native races have been wholly or in part replaced by their white rivals. The so-called yellow peril has not been nearly so portentous as the white peril has been to most peoples on the globe.

Nevertheless, in several parts of the earth the history of interracial contacts has recently passed, and in others will probably soon pass, into a different phase. In his Romanes lectures on "The Relations of the Advanced and Backward Nations of Mankind" Mr. James Bryce remarks:

Our own time stands eminent and peculiar in this, that it marks the completion of a process by which all the races of the world have been affected and all the backward ones placed in a more or less complete dependence upon the more advanced. India, northern Asia, the Indian and Polynesian archipelagos, the Philippine Islands now own civilized masters of European stock, as do all the aboriginal races of America. Turkey, Persia, Afghanistan, Siam and, in a sense, even China, are overshadowed by European powers and prevented from passing under the control of some one or more of these only by the jealous vigilance of the others. The same forces or motives have worked to bring this result about which have induced the conquests of earlier days. But two new factors have been more active and pervasive than ever before—the desire of civilized producers of goods to secure savage or semi-civilized consumers by annexing the regions they inhabit, and the rivalry of the great civilized states, each of which has been spurred on by the fear that the others would appropriate markets which it might win for itself. The process has been much swifter than was desirable in the interests of either con-

queror or conquered. But we can now see that it has become inevitable so soon as the progress of science had prodigiously increased the cheapness of both production and transportation.

This change, as Mr. Bryce points out, is giving the world a new kind of unity in which primitive peoples are taking positions analogous to those held by unskilled workers in civilized nations. The native peoples are becoming integral parts of the white man's economic order. "Such an event," Mr. Bryce remarks, "opens up a new stage in world history, a stage whose significance has perhaps been as yet scarcely realized either by the thinker or the man of action, because the historical thinker sometimes overlooks the present in his study of the past, while the man of action may be so much occupied by the present as to forget what the past has to teach him." The situation which Mr. Bryce describes is of great interest not only to students of economics and political science, but also to the biologist who is interested in the course of human evolution. It indicates a change in the course of biological development as marked as the change in the trend of political and economic history.

One of the most obvious biological effects of the extension of control over less advanced races is an increased stimulus to migration and race mixture. For long ages the evolutionary changes in the human species led to a continual divergence and redvergence into varied racial stocks. Through the effects of isolation and selection mankind has been broken up into innumerable subdivisions inhabiting different regions of the earth's surface. The geographical distribution of human races and peoples indicates that the process of speciation in man has followed much the same course that has led to the formation of races, subspecies and species among the lower animals. Whatever race fusion may have occurred was quite insufficient to counteract the evolutionary forces making for divergence during the early history of mankind. Now the course of development has been changed. The long period of divergence is being followed by a period of convergence. Peoples are mingling their blood to an extent that was unprecedented in previous history. Our greatly improved means of travel render extensive migratory movements relatively easy. Scarcely a tribe in the remotest islands of the Pacific is suffered any longer to lead a completely isolated existence. During the last few centuries the whites have not only spread into various regions of the earth and mingled their blood with native peoples, but they have caused great translocations in the populations of the countries subjected to their domination. Through their influence we find Hindus in South Africa and

Fiji, Negroes in Brazil, the West Indies and the United States, Chinese in the Philippines and Africa, and Filipinos in the United States and the various islands of the Pacific. Their development of the rich natural resources of Hawaii has caused an influx of hordes of Japanese, Portuguese, Chinese, Koreans, Filipinos, Porto Ricans, Negroes, and various other groups, forming a polychrome mass of humanity probably more diversified than the population of any other region of equal area on the face of the globe. All sorts of crosses are made in this seething cauldron of heterogeneous humanity. But this example is repeated to a less conspicuous degree in many other parts of the earth. It seems likely that with increasing trade and communication, together with the development of the relatively unutilized resources of many lands, the mingling of distinct racial stocks will go on at an accelerated pace.

The effects of white domination, in addition to accelerating race fusion, has in many parts of the world come to exert a more important influence in promoting the increase of native peoples. The unfavorable effects of contact to which we have referred may be only a temporary phase characteristic of what we may call the exploring and settling stage in the development of interracial relationships. This stage is well illustrated by the wide-spread depopulation which has been going on in Polynesia and Melanesia. But despite the predictions that many native peoples of the Pacific islands are doomed to extinction, we find that in several areas the natives are now increasing in number. The Maoris of New Zealand, who have long figured as an example of a disappearing race, have been increasing for some years. Since the beginning of the census enumerations in 1857-58 the Maoris continued to decrease up to near the beginning of the twentieth century. After this the five-year censuses have shown a slow increase of the Maoris, an apparent exception being afforded by the census of 1916, which indicated a decrease of 535 over the preceding period. This, as was explained in the census report, was due to the great war. The last five-year period showed the greatest increase of all. The half-castes, which were separately enumerated, are also increasing. The last (1931) Year Book of New Zealand states that "during the last few years the natural increase of the Maori population has exceeded that of the Europeans."

Notwithstanding the enormous hordes which have come into the Sandwich Islands, the native Hawaiians, after a long period of diminishing numbers, have recently been slowly gaining ground. The unmixed Hawaiians, however, have been decreasing, although at a diminishing rate, but if the mixed population is counted at only half its number the Hawaiians would

show an increase during the past two decades. Likewise, the natives of Fiji, who have been for a long time decreasing, and who have recently had to compete with a very extensive influx of Hindus, have begun to show a small surplus of births over deaths. The downward trend of population has been turned also in the Tonga Islands, the Carolines, New Britain, the Admiralty Islands and in many smaller areas. Mr. Roberts, in his volume on "Population Problems of the Pacific," estimates that of the total island population of the Pacific area 35 per cent. is increasing, 39 per cent. is stationary, and 25.5 per cent. is decreasing, with .16 per cent. faced with an immediate prospect of extinction. These figures relate only to the endemic peoples of these islands. It is a rather striking fact that the downward trend of native population has been stayed in face of a very extensive recent invasion by peoples from Asia, especially Chinese, Japanese, Koreans and Hindus. In 1923 about two fifths of the population of Fiji consisted of Hindus, most of whom had migrated into the islands since 1900. Throughout the Pacific area there is a great demand for labor. The resources of many islands are largely undeveloped, and it may be expected, therefore, that the inpouring of Asiatics will continue and that the spectacle of Hawaii will be repeated in many islands.

If we seek an explanation for the wide-spread trends of population in the Pacific area, we can detect the influence of several causes. For the most part they may be summed up as the result of the changing relationships of native races to the dominant whites or other ruling peoples. It is coming to be realized that the native populations of the islands are a valuable economic resource which it pays to conserve. The period of forcible recruiting of labor is past. Conflicts with native peoples have practically ceased. The lawless brutality that only too often resulted in much loss of life is rapidly passing. Wise administrators are endeavoring to understand native customs and to adopt more intelligent and considerate methods of control. The natives are not only learning much from their contacts, but they are securing the advantages of hygiene and sanitation instituted by their rulers and which compensate in a measure for the deleterious effects of the diseases with which the white man has presented them. A factor of especial importance, however, is the development of the resources of the islands, which makes possible the support of a much larger population than could formerly gain a subsistence. Natives are adjusting themselves to the economic and social organization of the more advanced races. The original antagonism is gradually changing into mutual and advantageous cooperation. In short, symbiosis is succeeding hostility. Instead of being a

scourge, the dominant race is a positive aid to survival. The natives are helped because they are coming to be a part of the white man's group.

Similar changes are occurring among the native peoples in other parts of the world. What statistical data we have on the native population of the Union of South Africa show an increase of the indigenous Bantu inhabitants, together with an increasing number of mixed breeds and incomers from Asia. The first effects of the invasion by whites in southern and especially central Africa were notoriously unfavorable to the increase of native peoples. Between war, the recruiting of slaves, the introduction of diseases and the demoralization of native customs, the Negroes suffered heavy losses, and in some parts white occupancy still exercises a baneful influence on the black population. As General Smuts remarks in his recent Rhodes lecture, "It is unfortunately the fact that throughout much of the African continent the native population is not increasing, and in some parts like Angola and the Congo it is definitely declining. The part of Africa in which the native population is increasing most rapidly within the last six years is the Union of South Africa, and that fact is a great tribute to the blessings of a settled European government, to the favorable economic conditions which render such an expansion possible, and to the medical care and welfare work carried on among the natives." In other parts of Africa the bad effects of the white invasion still predominate. According to a recent report on labor conditions in the Belgian Congo, the birth rate of the natives has fallen off to such an extent as to threaten the loss of man power needed in the industrial development of the region. The methods in vogue for recruiting labor are severely criticized in this report, and a plea is made for the employment of more humane and intelligent management of the Negro population in order to prevent the gradual loss of this valuable financial asset. The report is of interest in evincing a somewhat belated recognition of the value of policies which have elsewhere proven effective in conserving the supply of labor.

The British administration of India has led to a rapid growth of the native population, the last census showing an increase of some thirty million during the preceding decade. Since 1800 the indigenous population of Java has increased over tenfold under the administration of the Dutch. The Filipinos have about doubled in number since the United States came into control of the islands in 1898. The growth of the population in the West Indies is to a large extent the result of the development of the resources of these islands under the guidance of the whites. From the standpoint of racial replacement these

islands have an interesting history. The inhabitants of Jamaica, Haiti, Guadalupe, Martinique and the Barbados are now mainly blacks. The ruthless exploitation of the Spaniards greatly reduced the native Indian population of these islands, and the African slaves who were imported as a substitute for the natives were more successful in adjusting themselves to the economic régime of their masters. They thrived under white control and resorbed or replaced most of the natives who remained. Now the biological victory is clearly in the hands of the black man. The Caribbean has now become a great spawning area of black humanity from which numerous immigrants migrate into Mexico, Brazil, Venezuela, Colombia and Central America, where they contribute to deepen the shade of the mixed inhabitants of these countries. Several thousand have come into this country and we have at present no regular means of checking their influx.

Turning to our own race problem, we find that the trend of our Negro population is in some respects similar to that of native peoples in other parts of the globe. During the period of slavery, both master and slave profited from their association, and the Negroes multiplied at a rapid rate. After emancipation the Negroes became a more independent and, in some respects, antagonistic group. Being deprived of the care and supervision by their white masters, the Negroes came to suffer from an increased death rate, and their high birth rate began to fall. Sometime in the '80s the mortality of the Negroes began to decline, but the decrease of the birth rate caused the rate of natural increase to be reduced to such an extent that several writers have predicted that our own race problem would ultimately solve itself. Our Negro population never reached the stage of actually decreasing in numbers, but it came very nearly doing so. It has succeeded in establishing itself so that the advantages it secures apparently more than overcome the tendency of white competition to drive it to the wall. Advance returns of the latest census (1930) show that, after a period of diminishing rate of growth, our Negro population has come to increase at a more rapid rate. Between 1910 and 1920 the percentage of increase among the Negroes had fallen to 6 per cent. Between 1920 and 1930 the increase had risen to 13 per cent., or over double the rate of the previous decade. Even if, as has been maintained, many Negroes were not enumerated in the Census of 1920, it is scarcely credible that the number would be sufficient to account for the changing trend in our Negro population shown by the latest census returns.

This favorable turn in the biological fortunes of the Negro has taken place in spite of some untoward

circumstances. Chief among these is northward migration, which has certainly caused at least a temporary check in the natural increase of the migrants. Up to within recent years the opinion seemed to be well grounded that the Negro could not survive in the North. Deaths exceeded births among the Northern Negroes, and the growth of the Negro population in the Northern states has therefore been due mainly to migration. The black armies which have been pouring into the North have been marching to their own destruction. The first effects of the war migration were particularly unfavorable. Families were frequently broken, marriage was often deferred, and the difficulties of establishment in the new environment created a strong temptation to limit the family among married couples. But living conditions gradually improved. Negro mortality, and especially infant mortality, decreased, and now for several years the birth rate has been rising. The Negroes bid fair to succeed in adapting themselves to a northern climate and to increase through their own birth rate. They are gradually becoming immunized to tuberculosis, and they may come to constitute a larger and larger part of the moderate standard stratum of society which contributes most plentifully to the birth supply.

The restriction of immigration has greatly stimulated the northward trek of our Negro population. Not only unskilled labor, but much of the semi-skilled and skilled labor in our Northern centers of industry is being supplied by Negro workers, as it is in South Africa. As a whole, the Negroes, especially in the North, are becoming more and more an integral part of our social and economic organization. In some respects they do not belong to our group, but in other and very important respects they do, and this fact will have an important bearing on their future biological fate. They are reaping increasing rewards from the whites, not only economically, but also in the field of hygiene and sanitation. After a period of neglect, when the Negro was treated as an outsider to whom no obligations were due, there is coming to be more solicitude for his well being. It is distinctly possible that with change of relationship to the dominant race our Negro population, like the native peoples of the Pacific islands and other parts of the world, will take on a new lease of life.

It is to be regretted that our knowledge of the vital statistics of various peoples on the globe does not permit a more accurate estimate of their relative rates of natural increase. Over large areas of the earth's surface we have only very rough estimates of the number of existing inhabitants, and we know still less of their number in times past. Certainly, the white race has increased much more rapidly than the colored races, and it is probably doing so at the pres-

ent time. Nevertheless, the increase of the colored races has been to a large extent the result of the enterprise of the whites. Mr. Lothrop Stoddard's picture of the rising tide of color may not be so alarming in view of the present expansion of the white race. But if the whites are now gaining on their rivals they are scarcely justified in contemplating their future with entire complacency. Present rates of natural increase are of less importance than the kind of relations which are developing between the different races. It may well be that these relations may come to be such as to foster, much more than in the past, the increase of the relatively primitive members of a common social and economic organization. At times these relations may be symbiotic in all senses of the term. In a population of suboptimal density both a dominant and a subject race might increase more rapidly as a result of their association, but with increasing density of population this relationship changes. Although each race may contribute to the material welfare of the other, they may soon come to be rivals in reproduction in that the increase of one race will tend to check the increase of the other. And then symbiotic relationships may continue to exist between the low standard race and the employing class of the dominant race, but the relationship between the laboring populations in both races may be on a more competitive basis. Biologically, this kind of rivalry is particularly destructive to the race with higher standards of living. This fact was strikingly illustrated in the recent Mexican invasion of the Southwestern United States, where white labor was driven out of one industry after another by cheaper Indian labor from Mexico.

The fact that the interests of the employing classes are often opposed to the biological interests of their group as a whole makes the solution of many population problems a matter of great difficulty. The employing classes are politically powerful and their influence is apt to dictate the policy of the country. So long as their own welfare is enhanced by an alien element of the population, their influence will be exerted in favor of the aliens at the expense of the laborers of their own race. This same tendency is observed in the attitude of employers in South Africa, as it is in our own land. The Negro problem in South Africa is coming to be in many respects curiously like our own. Dr. J. W. Gregory, in his book on "The Menace of Colour," remarks, "The most ominous change in South Africa is the replacement of whites by blacks in many departments of work. The difference in South Africa between 1893 and 1905 which impressed me most deeply on visits in those years was the extent to which colored men had replaced white workers in many occupations. As the black man enters various branches of agricultural

and industrial occupations the white man goes out." The capitalists as a rule favor the policy which gives them the cheapest labor, regardless of the future of their own stock, just as they do in this country and everywhere else. Hence, they frequently incur the not unjust reproach of constituting the most effective enemies of their own race. According to Stevens, colored and Negro artisans by 1911 were in the majority in such occupations as blacksmiths, iron founders, brick workers, stone masons, carpenters, shoemakers, tailors and harnessmakers. Naturally, the white population is feeling acutely the pressure arising from the incorporation of the blacks into their own economic group. In proportion as the Negro succeeds in industry, in that proportion does he become a menace to white labor and the supremacy of the white race.

The tendency of industrial development to cause dominant peoples to be swamped out by the descendants of more primitive stocks who are utilized as laborers is one which every wisely governed people should consider with great care. Australia and New Zealand have saved themselves, at least temporarily, from being replaced by hordes of Asiatics before it became too late. Just as bad money drives out good money, so a low standard population tends to drive out a high standard population. How many dominant stocks have invited their own destruction by the importation of aliens to do the hard work I shall not presume to state. Dominant peoples naturally desire to avail themselves of the labor of less advanced races. Where the whites are able to administer dependencies inhabited by the colored races and to profit by the trade which results from such control, they may be enabled thereby to increase their own population and welfare, at least for a considerable time. This policy of exploitation has contributed not only to the increase of the white race, but it has aided also the increase of its rivals. It has led to the formation of many kinds of groups based on relationships of mutual dependence. The material needs for the support and increase of one people may be sup-

plied by natives in a remote quarter of the globe, so that we may have economic groups functioning more or less as units composed of natives in England, South Africa and Japan. It is largely the advantages which Japan has derived from Western culture since her former isolation that accounts for her phenomenal growth of population, which now adds about 800,000 annually to her already overcrowded area.

It is often said that the world is becoming an economic unit. Rather, it is a collection of units exhibiting various degrees of unity. Relative rates of population growth, migration, hence, the kind of racial replacement that goes on, and, hence the direction followed in biological evolution of various subdivisions of the human species, are to a large extent determined by the group relationships which develop as a result of the scramble for wealth. The student of the present evolution of our own species must concern himself not merely with the struggle between individuals or even neighboring groups, but with far reaching influences which tie together in bonds of common interest peoples of remote quarters of the globe and of most diverse racial extraction. And along with these new relationships of interdependence are developing new kinds of rivalry whose outcome can be only dimly foreseen.

In the present period of the world's history the white race, after having spread over and exploited very considerable portions of the earth's surface, and after having wrought unspeakable havoc as a result of its domination, has now come to minister to the welfare of its colored cohabitants, because it is finding them a valuable financial asset. At the same time, the whites must be credited with doing more for the less advanced races from motives of pure philanthropy. It may be financially profitable for a time to encourage population growth in alien lands. That many new kinds of competition will develop as the result of this policy seems inevitable. We have done much toward helping the meek to inherit the earth, but when they have come into a larger share of their patrimony they may not always be so meek.

SCIENTIFIC EVENTS

CONVICTIONS IN THE CALMETTE SERUM TRIAL

ACCORDING to a special cable to the New York *Times*, judgment in the Calmette serum trial, which opened on October 12, was rendered on February 6. Of the four defendants Professor Max Klotz and Anna Schuetze, a nurse, were acquitted. Professor Georg Deycke was sentenced to two years in prison and Dr. Ernst Altstaedt to fifteen months for homicide and inflicting bodily injury through culpable

negligence. Dr. Deycke and Dr. Altstaedt were acquitted on a count charging the same offense in the introduction of the Calmette treatment in Luebeck.

In an oral opinion Presiding Judge Wibel said that the deaths of 68 of the 76 children who died of tuberculosis in the spring of 1930 and the illness of a majority of 131 survivors who then contracted the same illness were attributable to their inoculation with virulent tuberculosis bacilli inadvertently introduced into the Calmette vaccine. While the court admitted

the theoretical possibility that vaccines might revert to virulence, it held this was not practically admissible in this case. In the Luebeck Hospital laboratory Calmette cultures were prepared side by side with human tuberculosis bacilli, he said, and these two must have been accidentally confounded.

Such a mistake, the court held, was indicated by expert opinions, especially those regarding conditions in the hospital laboratory. The laboratory, while good enough for ordinary purposes, was unfit for the preparation of vaccine, and the court was convinced that the catastrophe had been caused by defects in the institution. The responsibility, therefore, rested primarily on Dr. Deycke, who as an expert bacteriologist knew the danger of a possible mistake or contamination. The precautionary instructions he had given were inadequate for certainly preventing them, the court held, the more so since, being overworked, he could not always supervise the laboratory personally.

The court held further that it had been established with a probability bordering on certainty that the catastrophe would have been averted had the vaccine been tested on animals before it was administered and that the tuberculosis outbreak would not have reached such dimensions had control through inoculation of animals been established. The responsibility for the omission was therefore held to rest also on Dr. Altstaedt, whose duty it was as chief health officer to make sure of the safety of the laboratory procedure.

Professor Albert Calmette, of Paris, the originator of the Calmette anti-tuberculosis serum, did not appear at the trial, but pleaded for the German physicians, saying that the hospital equipment was inadequate and that his colleagues should not be blamed. The serum was provided from the Pasteur Institute in Paris in July, 1929.

THE INTERNATIONAL SCIENTIFIC EXPEDITION

THE Department of the Navy has issued a statement to the effect that the *U. S. S. S-48* and the *U. S. S. Chewink*, naval ships on board which scientists of the International Scientific Expedition will cruise for two months while measuring ocean depths and the pull of gravity in the vicinity of the West Indies and the Bahamas, sailed on Sunday, February 7, from Guantanamo Bay on the first loop of their cruise.

The part of this first loop to be covered by the two ships lies southward of the Island of Jamaica and around the west end of Cuba, including 18 gravity stations, cruising about 1,125 miles and ending at Key West on February 11. There, computation of recorded data and a check-up with shore

gravity stations were undertaken, after which the two ships left on the second portion of this loop, extending up the Florida Straits and the Old Bahama Channel.

Investigators embarked in the *S-48* and the *Chewink* are Dr. F. Vening Meinesz, member of the Geodetic Commission of the Netherlands; Mr. Harry Hess, proctor fellow in geology at Princeton University, and Mr. Townsend Brown, of the United States Naval Research Laboratory. Lieutenant Commander Allen H. Gosnell, U. S. Naval Reserve, is accompanying this unit of the International Scientific Expedition in the capacity of historian.

Professor Richard M. Field, director of the expedition, has sailed from Miami for study of the structural geology of the outer Bahamas, this study to be supplemental to the gravimetric survey being made beneath the sea by Dr. Meinesz.

In commenting in his dispatch on preparations made since the Meinesz unit of the expedition sailed on January 27 from Norfolk on board the *U. S. S. Tarbell*, destroyer, Lieutenant Commander Gosnell reports as follows:

Set up gravity apparatus on deck of *Tarbell* in lee of Crooked Island January 29. Dr. Meinesz, Hess and Brown in Santiago during earthquake of February 3. Escaped safely from hotel and spent remainder of night on bench in Plaza. *S-48* and *Chewink* arrived at Guantanamo February 4. Commenced work on iron framework for apparatus.

On February 5, ships successively at sea testing all depth-finding installations. February 6, charging batteries and completing preparations for test of all gravity apparatus. This test in progress February 7 alongside dock. Prior to arrival of ships, party was engaged in working up results of tests made at Naval Research Laboratory.

SCIENTIFIC PROBLEMS OF THE ARCTIC

THE United States has been slow about joining the other nations in plans for studying scientific problems in the colder regions of the earth during August, 1932, to August, 1933, but Science Service reports that it will probably take part and establish a station at Fairbanks, Alaska. All that is needed is the money—\$30,000—and the Senate Foreign Relations Committee has reported out the bill authorizing this expenditure. It is expected to pass, despite the depression, and the economy program of the administration. Recommendations in its favor were made to the committee both by President Hoover and Secretary of State Stimson.

Twenty-six nations have arranged to take part in this "Second Polar Year Program." The United States will make the number twenty-seven. Subjects to be studied are the magnetism of the earth; the

aurora or polar lights; the natural electric currents which flow in the earth's crust; the electric condition of the atmosphere; the relation of radio transmission and reception to all these phenomena and to the condition of the surface of the sun, also meteorological conditions to great heights in the atmosphere.

The Senate committee in making its favorable report for authorizing the \$30,000 expenditure said:

It must not be forgotten that this polar year program has by now become irrevocable, except in the event of direct calamity. Too many nations have already made extensive preparations for the work to permit its being dropped except under very special circumstances. There is at present not the slightest prospect that it will be dropped. The present plan is that the United States of America shall provide funds for a polar-year station at Fairbanks, Alaska. The request for \$30,000 has been made with full realization that adverse economic conditions demand that the amount shall represent the irreducible minimum for carrying on the work at that station.

Fairbanks, Alaska, occupies a key position in the distribution of polar-year stations. There are no other stations near-by—in fact, unless Fairbanks is occupied as a station, about one fourth of the Arctic region will be totally neglected. . . . Economically we are probably not worse off than are other nations that are participating.

COMMITTEE ON NOISE MEASUREMENT OF THE AMERICAN STANDARDS ASSOCIATION

THE organization of a sectional committee on noise measurement under the procedure of the American Standards Association was recommended by a general conference of 32 representatives of 18 national bodies held in New York on January 29. It was also recommended that the committee function under the technical leadership of the Acoustical Society of America.

The scope of the project as recommended by a steering committee consisting of Professor Vern O. Knudsen, Acoustical Society of America; E. E. Free, American Society of Mechanical Engineers; P. L. Alger, American Institute of Electrical Engineers; H. R. Summerhayes, National Electrical Manufacturers Association; R. G. McCurdy, ASA Telephone Group; and Dr. Harvey Fletcher, Acoustical Society of America, is the "Preparation of general standards of nomenclature, units, scales and measurement in the field of acoustics, with special reference to noise measurements."

The conference followed a request made by the Acoustical Society of America to the American Standards Association to set up a national committee to correlate the activities of various technical and trade organizations which have been attempting indi-

vidually to set up standards for noise measurement. Eight such organizations now have committees on this subject. It was pointed out that the diverse nomenclature and methods of measurement growing out of these uncorrelated activities were interfering with the progress of scientific work on the subject and that without real national standardization this condition would become worse as different individuals became accustomed to different concepts and terms.

For the present the committee's work will be concentrated chiefly on the standardization of nomenclature, units and scales. It is believed that further progress in the science of noise measurement is necessary before effective standardization of this phase of the subject can be completed. There is some confusion in the measurement of noise at the present time because of the complex nature of noises and their effect upon the ear, and the fact that none of the noise meters yet designed can translate the approximate physiological and psychological effects of noise into definite units of measurement. Dr. Harvey Fletcher, of the Bell Telephone Laboratories, pointed out at the conference that to the average individual a noise composed of widely separated frequencies is less disturbing than a noise of equal intensity, but having components close together in the frequency range.

SUPPORT FOR BIOLOGICAL ABSTRACTS

DURING the year 1931 the following sums have been contributed to *Biological Abstracts* and to the Union of American Biological Societies in support of this publication:

To the Union of American Biological Societies

American Association for the Advancement of Science	\$ 400.00
American Association of Anatomists	100.00
American Physiological Society	125.00
American Society of Biological Chemists	100.00
American Society for Experimental Pathology	50.00
American Society of Naturalists	50.00
American Society for Pharmacology and Experimental Therapeutics	50.00
American Society of Zoologists	200.00
Botanical Society of America	150.00
National Research Council	1,500.00
Society of American Foresters	50.00
Contributions by individuals	55.00
Total	\$2,830.00

To *Biological Abstracts* directly

American Society of Naturalists	\$ 50.00
American Society of Zoologists	500.00
Total	\$550.00

An accounting for expenditures under these sums, as received to December 15, 1931, was made by the

treasurer of the union at the meeting of the council of the union in New Orleans on December 28. The results of the solicitation of subscriptions in recent months have thus far led to cash receipts to *Biological Abstracts* that exceed by several hundred dollars all the funds expended during 1931. This is comparable to turning over cash to the *Abstracts* in excess of all money contributed by the societies and in addition financing all activities of the union on behalf of the *Abstracts*. Moreover, the newly acquired subscriptions are likely to be continued in subsequent years, and the activities of the union have been given publicity that should have a continuing value.

In addition to the contributions listed, the American Society of Zoologists passed the following motion by unanimous vote of the forty-five members in attendance at the business meeting held in New Orleans December 30, 1931:

It is moved, subject to approval by two thirds of the members voting in a mail ballot to be sent out by January 10 and returned by February 1, 1932:

(1) That the annual dues be advanced to \$5.00 of which \$3.00 shall be paid by the Treasurer to *Biological Abstracts* with the proviso that any member or associate

member subscribing to this publication shall have this \$3.00 credited upon his subscription.

(2) That for the year 1932 and for any later years the Executive Committee be authorized to reduce this addition to the dues by such amounts paid from funds then in the treasury as may be possible without undue reduction of the balance desirable for current activities of the society.

The returns from this mail ballot among life and active members are: 256 for the motion; 60 against. Ballots were also sent to the associate members, who pay the same dues as the full members of this society but have no votes, in order that their sentiment might be recorded. The returns from this vote by associate members are: 48 for the motion; 8 against.

In addition to the substantial amount involved, this action by the zoologists is important because it points the way for societies to support the *Abstracts* even though there may be no immediate prospect of making full subscription a condition of membership.

W. C. CURTIS,

President of the Union of American Biological Societies

SCIENTIFIC NOTES AND NEWS

ON the occasion of his sixtieth birthday anniversary on February 5 Dr. Lafayette B. Mendel, professor of physiological chemistry at Yale University, was presented with a portrait of himself painted by John Quincy Adams, the Viennese artist. Over four hundred students and associates participated in making the gift "in recognition of Professor Mendel's long and distinguished service as a teacher and as a leader in his field of science."

DR. JOHN M. T. FINNEY, professor of clinical surgery at the Johns Hopkins University, received on February 1 the Bigelow medal of the Boston Surgical Society. At the meeting when the presentation was made he spoke on "Changing Methods of Surgery."

THE faculties of Northwestern University gave a dinner on February 19 in honor of their colleagues who had taught in the university for twenty-five years. These included Dr. Thomas F. Holgate, professor of mathematics and dean emeritus of the College of Liberal Arts. Dr. Holgate was acting president of the university from 1904 to 1906 and from 1916 to 1919.

DR. W. B. MERCIER, director emeritus of the agricultural extension division of the Louisiana State University, was awarded the distinguished service ruby of Epsilon Sigma Phi, honorary agricultural extension fraternity, at a recent meeting in Chicago. Only

three others have received this honor, which is given in recognition of meritorious service to agriculture.

AT the recent elections of the Société de Biologie of Paris, Dr. A. F. Blakeslee, of the Department of Genetics of the Carnegie Institution of Washington, was made an associate, having previously been a corresponding member of the society.

THE Duddell Medal of the Physical Society of London has been awarded to Professor C. T. R. Wilson, Jacksonian professor of natural philosophy in the University of Cambridge.

DR. DAVID HILBERT, professor of mathematics at Göttingen, celebrated his seventieth birthday on January 23. Dr. Carl Duisberg, professor of chemistry, celebrated on January 21 the fiftieth anniversary of his doctorate.

DR. L. H. ADAMS, of the Geophysical Laboratory of the Carnegie Institution, has been elected president of the Washington Academy of Sciences. Dr. W. S. Eichelberger, director of the Nautical Almanac Office of the U. S. Naval Observatory, and Dr. W. H. Wilmer, director of the Wilmer Institute of Ophthalmology of the Johns Hopkins University, have been elected non-resident vice-presidents.

AT the thirty-ninth annual meeting of the Geological Society of Washington, Dr. François E. Matthes, of the U. S. Geological Survey, was elected president.

At the annual meeting of the Southern Division of the American Phytopathological Society at New Orleans, Dr. L. E. Miles was elected to represent the division on the council of the society, and an executive council for the division was elected consisting of Dr. R. F. Poole, Dr. C. D. Sherbakoff, Dr. Miles and Dr. W. N. Ezekiel. At a subsequent meeting of this council, Dr. Poole was designated as chairman and Dr. Sherbakoff as secretary.

MR. FRANCIS P. GARVAN, president of the Chemical Foundation, was elected president of the U. S. Institute for Textile Research, at a recent meeting of the directors. Mr. Garvan succeeds the late Dr. Samuel W. Stratton, formerly president of the Massachusetts Institute of Technology, who had been the first president of the institute.

DR. CONRAD BECK, director of R. and J. Beck, Limited, scientific instrument manufacturers, has been elected president of the Royal Microscopical Society; Mr. A. Earland, Dr. R. Ruggles Gates, Mr. J. Reinberg and Dr. G. S. Sanson have been elected vice-presidents.

THE title of professor of biochemistry has been conferred on Dr. Robert Robinson, of the Lister Institute of Preventive Medicine, and that of reader in biochemistry on Dr. J. M. Gulland, also of the institute, and on Dr. William Robson, of King's College.

THE following appointments have been made at the University of Sheffield: Mr. B. H. Bentley, at present lecturer in botany, as professor of botany; Dr. R. N. Rudmose Brown, at present lecturer in geography, as professor of geography; Mr. L. E. S. Easthem, as professor of zoology; Dr. J. Florey, as professor of pathology, and Dr. J. W. Edington, as professor of bacteriology.

MR. ANDREW THOMSON, previously aerologist for the Meteorological Service of New Zealand and for some years director of the Apia Observatory, has been appointed meteorologist in the Canadian Meteorological Service.

DR. A. B. STOUT, director of the laboratories of the New York Botanical Garden, is spending February and March in southern Florida in further studies of flower behavior and fruit production of avocados.

LEAVE of absence from the University of Michigan has been granted to Dr. Warren Weaver, professor of mathematics; F. P. Woy, professor of engineering administration, and Dr. Gordon Ritchie, assistant professor of pathology.

DR. GEORGE C. SHATTUCK, assistant professor of tropical medicine at the Harvard Medical School, sailed from New York on January 23 for Pt. Barrios,

Guatemala, where he will undertake research work under the auspices of the Carnegie Institution. Accompanying Dr. Shattuck is Dr. John L. Bremer, Hersey professor of anatomy. The party will explore also the Mayan ruins in northern Guatemala.

DR. J. W. GREGORY, professor of geology in Glasgow University, has arrived in Lima, Peru, at the head of a scientific expedition to study geological formations of the mid-Andean range. The expedition will continue from Peruvian territory into Bolivia and Chile.

PROFESSOR H. J. MULLER, of the University of Texas, delivered two addresses at the Johns Hopkins University on February 8. He spoke before the genetics seminar of the department of zoology on "Mutation, Positive and Negative" and at the Johns Hopkins Hospital on "X-ray Mutations in Relation to Medicine."

DR. E. V. MCCOLLUM, of the Johns Hopkins University School of Hygiene, lectured on January 15 before the North Carolina section of the American Chemical Society, on "The Chemical Background of the Science of Nutrition."

DR. THOMAS S. CULLEN, professor of gynecology at the Johns Hopkins Medical School, delivered the Phi Beta Pi Lecture at the Vanderbilt University School of Medicine on February 16. His subject was "Gynecology of Yesterday and of To-day."

DR. ALBERT EINSTEIN gave a lecture on "The Geometric Interpretation of the Gravitational and Electric Field" at the University of California at Los Angeles, on February 15. Dr. Einstein spoke in German, and his address was translated by Dr. Richard Chase Tolman, professor of physical chemistry and mathematical physics, of the California Institute of Technology.

THE annual public Darwin Anniversary Address, under the auspices of the Botanical Seminar of Michigan State College at East Lansing, was given on February 12 by Professor Charles E. Allen, head of the department of botany of the University of Wisconsin.

THE Non-Resident Lectureship in Chemistry at Cornell University was established by Mr. George Fisher Baker in 1925. Up to the present time the lecturers under this plan have come from abroad, each of them remaining at the university for a full term. It is now planned to expand the program by inviting leading chemists of this country to give one or two lectures before the department on the Baker Foundation. Lecturers and their subjects for the coming university term are as follows: March 7, Professor

Roger Adams, University of Illinois, "Stereochemistry of Substituted Diphenyls"; March 22 and 23, Dean S. C. Lind, University of Minnesota, "Chemical Action under Alpha Radiation" and "Chemical Action in Electrical Discharges"; April 19, Mr. George W. Morey, Geophysical Laboratory, Carnegie Institution, "Transport of Material through a Vapor Phase"; May 2 and 3, Professor R. A. Gortner, University of Minnesota, "Biochemistry and the World To-day" and "The Electrical Value of Forces at Interfaces," and May 17, Mr. R. S. Wilson, Standard Oil Company, Chicago, "The Mechanics of Lubrication."

DR. E. MOLES, general secretary of the Ninth International Congress of Pure and Applied Chemistry, which was to have been held at Madrid, April 3-10, writes as follows: "We have the honor to inform you that the Bureau of the International Union of Chemistry has met with the Delegates of the Organizing Committee specially invited to this meeting, Professor Biilmann acting as president. They considered with care the situation produced all over the world by the economic crisis. If our congress has to be held under such unfavorable circumstances it would necessarily be limited in its efficacy. Subsequently the bureau resolved by common consent with the Organizing Committee to postpone the Ninth International Congress of Chemistry until happier times, that we eagerly hope will arrive quickly. In any case the postponement will affect at least the whole year of 1932. Madrid will be kept as the place of meeting of the next congress. You collaborated very kindly in announcing the congress. Would you be kind enough now to publish the postponement?"

THE American Association of Physical Anthropologists will hold its annual meeting at the Smithsonian Institution, Washington, D. C., on March 21, 22 and 23.

THE Graduate School of Tropical Agriculture at the University of Hawaii announces four graduate research fellowships: two in chemistry in the Experiment Station of the Hawaiian Sugar Planters Association and two in entomology in the Experiment Station of the Association of Hawaiian Pineapple Cannerys. The stipend of the fellowships is \$1,500 for the year 1932-33. Fellows are eligible for reappointment the second year.

THE annual meeting of the committee on the C. M. Warren Fund for Chemical Research of the American Academy of Arts and Sciences will be held in May, 1932. Applications for grants not exceeding \$500 in amount should be in the hands of the chairman, Professor James F. Norris, Massachusetts Institute of Technology, Cambridge, Massachusetts, not later than April 1. Applicants should submit a statement of

the significance and plan of the proposed research, and the manner in which the money requested is to be used.

The Experiment Station Record reports that a citrus laboratory is to be erected by the Bureau of Chemistry and Soils of the U. S. Department of Agriculture on the grounds of the substation at Weslaco, Texas, in the Rio Grande Valley, for the study of citrus fruit culls and their by-products. A building for this work is to be erected by the chambers of commerce of Weslaco and Mercedes. The first year's program will center largely around problems of grapefruit utilization, including the stage of maturity most favorable for preservation, the utilization of waste from canneries and juice factories, and the feasibility of preparing grapefruit oil, pectin, naringin and other valuable constituents from oil and waste material.

THE *London Times* reports that a British expedition is being formed under the leadership of Mr. Frank Smythe which, subject to permission from the political authorities, will this year attempt to climb Nanga Parbat, in Kashmir, the highest peak in the Western Himalaya. Nanga Parbat stands 26,629 feet high. It is the sixth or seventh highest peak in the world. It was visited in 1895 by a party consisting of A. F. Mummery, General (then Major) Bruce, Professor Norman Collie and Geoffrey Hastings. Mummery made an attempt to climb it accompanied by a single Gurkha, and got to 20,000 feet. Subsequently Mummery, with two Gurkhas, left the base camp to cross the Diamir Pass. They disappeared, and no trace of them was ever discovered. The new British expedition will go prepared for a three months' "siege." It is thought that the knowledge gained in recent British and German expeditions to Kamet and Kanchenjunga may be of use. Mr. Smythe was the leader of the small party which last year conquered Kamet, and a member of the Dyhrenfurth Expedition which attempted Kanchenjunga the previous year.

ACCORDING to the *Journal* of the American Medical Association the new Edward Mallinckrodt Institute of Radiology, at Washington University School of Medicine, St. Louis, representing an investment of \$1,220,000, is now in almost complete clinical operation. The eight-story building houses the roentgenologic activities of the school of medicine and the allied hospitals. The second, third and fourth floors are reserved for general roentgenologic, surgical urologic and gastro-intestinal diagnoses; the waiting rooms have been planned to eliminate confusion in separating hospital and dispensary cases and making further division of patients by sex and race. The time necessary for a diagnosis has been shortened by having dark rooms on each of these floors, all the chem-

icals for which are mixed in central tanks on the fifth floor and fed to the individual dark rooms below through specially constructed pipes. The fifth floor has been set aside for treatment work, the sixth for research in the physics of radiation, and the seventh for roentgen research on animals, but these are not yet in use. Since treatments comprise less than 5 per cent. of the work done at the institute, they are now being given in smaller quarters in the basement. The institute was erected under the direction of Dr. Sherwood Moore with funds provided by the late Edward Mallinckrodt, Sr., and Mr. Edward Mallinckrodt, Jr. Special apparatus, worth \$20,000, was provided by John F. Queeny and his son, Edgar M. Queeny, and the General Education Board gave the endowment of \$750,000. A memorial room is planned on the main floor of the institute for Dr. R. Walter Mills, who, as director of the department of radiology, planned the development of the institute. Dr. Mills died in 1924 from over-exposure to x-rays. Since his death, the project has been carried on by Drs. Moore, Evarts A. Graham and W. McKim Marriott, dean of the medical school.

ACCORDING to the *Journal* of the American Medical Association the Henry Barton Jacobs collection of medical books, prints, medals and autograph letters was formally presented to the Institute of the History of Medicine of the Johns Hopkins University, on January 14, by Dr. Henry Barton Jacobs. What is believed to be the world's only complete collection of the writings of René-Théophile-Hyacinthe Laënnec (1781-1826) is included in the gift. Included also are complete collections in all editions and all western languages of the writings of Edward Jenner (1749-1823), Louis Pasteur (1822-1895) and Sir William Osler (1849-1919). The collection consists of 5,000 volumes, about 2,500 medical prints, 500 medical medals and about 300 autograph medical letters and manuscripts. Stained glass windows commemorating Laënnec, Jenner, Pasteur and Osler have been placed in the room which Dr. Jacobs has equipped on the institute floor of the library for housing the collection as a unit. Dates, medical symbols and works associated with the men they commemorate are worked into the design of the windows. The collection was accepted on behalf of the university by Mr. Daniel Willard, president of the board of trustees; President Joseph S. Ames presided. The speakers included Dr. William H. Welch, Dr. Harvey Cushing, Colonel Fielding H. Garrison and Dr. Jacobs. Dr. Jacobs was recently elected president of the Friends of the Johns Hopkins University Library.

It was announced a few months ago that the International Institute of African Languages and Cultures

had received from the Rockefeller Foundation a substantial grant for the development of sociological research in Africa. The *London Times* now reports that the council of the institute, after consultation with anthropologists in several countries and with African administrators and educators, has decided that the best use that can be made of the resources at its disposal is to encourage and assist studies directed to a single main objective. It has selected as this objective the problem of the cohesion of African society. Native society in Africa is subjected to a severe strain through contact with the ideas and economic forces of European civilization. The object of the proposed study will be to obtain a better knowledge of the bonds which hold African society together and unite its members in a common discipline and mutual loyalty, of the ways in which these bonds are being modified or destroyed by the new forces that are invading the continent, and of the new social groupings which are replacing those that are unable to survive in the changed conditions.

Nutrition Abstracts and Reviews, a new periodical dealing comprehensively with the nutrition of man and the lower animals, has just been issued under the direction of the Imperial Agricultural Bureaux Council, the Medical Research Council, and the Reid Library, Aberdeen, Scotland. Its editorial staff, headed by John Boyd Orr, is assisted by corresponding editors in twenty-nine other countries. The corresponding editors in the United States are Dr. H. C. Sherman, Columbia University, and Dr. J. R. Mohler, chief of the Bureau of Animal Industry, U. S. Department of Agriculture. *Nutrition Abstracts and Reviews* contains editorial comment and brief articles by leading authorities, but consists principally of abstracts classified in six main sections for the convenience of workers in various fields. The abstracts present scientific findings reported in about 450 periodicals. A short book-review section concludes the volume, the first of which contains 351 pages and covers the period January 1 to June 30, 1931.

A LIBRARY of British Empire films has been formed by the Empire Marketing Board and the first catalogue, containing the names of over 130 films, has been issued. Schools in all parts of the country are now receiving regularly short films of life and work overseas. These have been catalogued under countries, and practically every school in the United Kingdom will receive a catalogue. Mr. John Grierson, the board's film officer, recently visited Canada and brought back much material from the Canadian Government Motion Picture Bureau. There is now a particularly good selection of Canadian films, ranging from pictures of production—the felling of lumber, harvesting of apples and catching of salmon—to fight-

ing forest fires with seaplanes, camping in the Rockies and other aspects of life in the Empire. Films of how people live and how the Empire's food is raised in other Dominions and in several of the Colonies are included in the catalogue. Over 2,000,000 people, of whom about half were school children, have now attended the Imperial Institute cinema at Kensington, where the Empire Marketing Board films are shown continuously. One of these pictures is described as a "dramatized lesson in economic history," and shows, in a series of swift, vivid flashes, the development of the North American prairies. Another is a one-reel version of *Drifters*, a film epic of the North Sea.

Forty of the states and territories will spend a total of \$201,917 for growing and distributing trees for planting of farm forests in 1932, according to budget figures received by A. B. Hastings, chief of state cooperation in the forest service. The federal government will allot \$73,288 to these states under the cooperative farm-forest planting clause of the Clarke-

McNary Act. The cooperating states have budgeted \$645,298 for various forest-tree production and distribution purposes for the fiscal year 1932, which is only about \$5,000 less than the 1931 total. About 31 per cent. of the total state funds will be used for farm-forest planting arrangements in which the federal government is cooperating. In addition to the \$73,288 in federal allotments for 1932, \$3,150 is to be available for administrative purposes and \$18,561 as a contingent fund for allotments to new states entering the cooperative arrangements, making a total federal budget of \$95,000 for aid in farm forestation. With the 1931 state and federal funds the states furnished approximately 25,000,000 trees for planting in farm forests. Comparatively large increases in cooperative state funds devoted to farm-forest planting projects were budgeted in New Jersey, Indiana, Florida, Nebraska, Louisiana, Oklahoma, Pennsylvania and South Carolina, with lesser increases in Delaware, Maryland, Washington, Michigan and Wisconsin.

DISCUSSION

ASYMMETRIC VALLEYS AND CLIMATIC BOUNDARIES

IN a recent article in *SCIENCE*¹ Russell discusses the coincidence of position of the January isotherm of 32° F. with certain asymmetric valleys having the steeper slopes facing north. The writers believe that Russell is correct in emphasizing climatic conditions as a cause for asymmetry and in considering the freezing of soil water as of great importance. They doubt, however, that he has established any association between a given type of asymmetry and any isothermal line.

In enumerating the causes of asymmetry, Russell neglected to mention the factor of stream deflection due to the earth's rotation. This factor was given more consideration by Gilbert and his contemporaries than is now customary. However, before climatic generalizations are established, asymmetric valleys attributed to this cause must be satisfactorily eliminated. One of the best known examples lies on the January isotherm of 32° F. and one lies far south.

Fuller,² in regard to asymmetric valleys of southern Long Island, declares that a full four fifths of these valleys have a steeper western slope. In his opinion, the deflection hypothesis of the early workers is the best explanation available. On Martha's Vineyard are similar valleys to which the same argument is applicable. Thus we have, directly under the isothermal line in question, examples of an asymmetry apparently unrelated to climatic conditions.

The marked asymmetry of the valleys of the coastal

plain of North and South Carolina is characterized by steeper, north-facing slopes. These valleys lie several hundred miles south of Russell's line and nearer the January isotherm of 40° F. According to Kerr,³ these valleys are due to right-hand deflection of streams.

The detailed, irregular, isothermal line on Russell's maps⁴ appears to cross the Pajarito Plateau of New Mexico, described by Henderson.⁵ Here are asymmetric valleys with the steeper slope facing the south. A comparison of Henderson's description with Culbertson's⁶ description of the wooded, asymmetric valleys of southern Indiana brings out clearly how—along the same (January, 32° F.) isothermal line—the same processes may produce diametrically opposite results in arid and in humid climates.

Asymmetry is not uncommon in arid regions and has been observed by Bryan at many localities in southern Arizona. Generally the south side of the valley has the gentler slope and is marked by heavier vegetation. The interrelation seems obvious: shelter from the sun's rays decreases soil evaporation and transpiration; consequently plants thrive and in turn protect the slope from the violent erosive action which makes the north slope bare and steep.

³ W. C. Kerr, "Topography as Affected by Rotation of the Earth," *Proc. Am. Phil. Soc.*, 13: 190-192, 1873.

⁴ R. J. Russell, "Dry Climates of the United States: I, Climatic Map," *Univ. Calif. Publ. Geog.*, 5: 1-41, 1931.

⁵ E. L. Hewett, J. Henderson, W. W. Robbins, "Physiography of the Rio Grande Valley, N. M., etc.," *Bull. Bur. Amer. Ethnol.*, 54: 1913.

⁶ G. Culbertson, "Some Evidence Indicating the Importance of Frost Action in Widening Valleys," *Proc. Ind. Acad. Sci.*, 1899: 167-170, 1900.

¹ R. J. Russell, "Geomorphological Evidence of a Climatic Boundary," *SCIENCE*, 74: 484-495, 1931.

² M. L. Fuller, "Geology of Long Island," *Prof. Paper* 82: 50, 1914.

It seems that Russell's idea of a correlation between frost action and some one isotherm has merit. Frost action is doubtless of great importance in the asymmetry of valleys in humid lands, though perhaps of less importance in arid regions.

In the North America Continent nearly all the area north of the isotherm of 32° is glaciated and only post-glacial valleys can show asymmetry. Many of these are, however, too youthful. It may be that all the humid area north of the isotherm where frost action is prevalent would in turn develop asymmetry. Obviously the nearly unglaciated northern portion of Asia is the region for testing this question. Asymmetry in the valleys of the northward flowing rivers of Siberia has already been reported and attributed to right-hand deflection. The characteristic of smaller valleys, so far inadequately described, would appear to be critical.

KIRK BRYAN

SHIRLEY L. MASON

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METEORIC DUST

SCIENCE NEWS, in SCIENCE for January 22, contains an article on "Meteoric Dust," to one paragraph of which I feel bound to take exception.

It is not a fact that I have been collecting meteoric dust "over a period of thirty years." Of course, meteoric dust, like rain, falls alike on the just and the unjust; but that is not scientific collecting.

It is true that certain samples of dust, from roofs, towers, flues and locomotive smoke boxes, have been examined by me, using quite simple, even crude apparatus. In the outdoor dusts there were found both magnetic globules and glassy globules. Flues of anthracite furnaces show occasional magnetic globules, and the dust from locomotive smoke boxes contains them in large proportion, whence I take it that locomotives are efficient, if not sufficient, producers of the magnetic globules in atmospheric dust.

The glassy globules appear in dusts from house roofs and towers; *e. g.*, in deposits on the flat roof of Building C, Harvard College Observatory, where they are in the winnowings of thirty years; in dust from a house roof in Chippewa Falls, Wisconsin; and in the dust on the upper platforms of the Pilgrim Memorial Tower, Provincetown, Massachusetts.

Such globules were reported by Thoulet in 1908 as existing in the dust from towers of the cathedral in Nancy, France. I do not find them in anthracite flues or in locomotive dusts. But I have not examined dusts from glass works or from mineral wool factories; and the samples from locomotives have been too few for generalization. Some well-equipped mineralogist might pursue the subject to advantage.

Until some one discovers a criterion for the identifi-

cation of meteoric dust, the only course is the exclusion of alternatives. This exclusion seems to be satisfactory in three cases: the sample from the ship *Joshua Bates*, studied by Ehrenberg, the magnetic globules of Murray and Renard, found in the "red clay" deposits of the deepest seas, and the sample collected on November 16 and 17, 1897, in Dublin, Ireland, and analyzed spectroscopically by Hartley and Ramage.

Thoulet was probably hasty in assigning a cosmic origin to the Nancy globules; and a considerable search for alternatives is necessary before calling the glassy globules which I have found meteoric or cosmic.

WILLARD J. FISHER

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THE OESTRUS-PRODUCING HORMONES

THE recent note by Marrian and Butenandt¹ contains several statements which can hardly be substantiated if one refers to our original papers. Our first paper² on theelol appeared in the October issue of the 1930-31 *Proceedings* of the Society of Experimental Biology and Medicine and Marrian's³ paper was received by us on October 28, 1930. We characterized the triol as an unsaturated trihydroxy compound having a formula $C_{18}H_{24}O_3$ and a melting-point of 273° C. The tri-acetyl derivative had a melting-point of 126° C. In a later paper,⁴ the one about which Marrian and Butenandt complain, Marrian's data are compared with ours in adjacent columns of Table I and some discussion is given in the text. The table contains Marrian's carbon and hydrogen analysis, the molecular weight, melting-point, formula and the fact that Marrian found 3 hydroxyls per molecule. In the text we expressed the belief that Marrian might have an isomeric triol or an impure triol and that, if the latter were true, the contaminating substance might be theelin.

It is also stated that we have ignored the evidence of Marrian's analytical data. We doubt whether carbon and hydrogen analyses would detect the presence of amounts of theelin ($C_{18}H_{22}O_2$) up to 10 per cent in otherwise pure theelol ($C_{18}H_{24}O_3$), whereas the melting-point would certainly reveal the presence of the impurity. In our preparations we have frequently obtained about ten times as much theelol as theelin.

The complaint that Butenandt's conversion of $C_{18}H_{24}O_3$ to $C_{18}H_{22}O_2$ has not been properly recog-

¹ G. F. Marrian and A. Butenandt, *SCIENCE*, 74, 547, 1931.

² E. A. Doisy, *et al.*, *Proc. Soc. Expt. Biol. and Med.* 28, 88, 1930.

³ G. F. Marrian, *Biochem. J.*, 24, 1021, 1930.

⁴ S. A. Thayer, L. Levin and E. A. Doisy, *J. Biol. Chem.*, 91, 655, 1931; E. A. Doisy and S. A. Thayer, *J. Biol. Chem.*, 91, 641, 1931.

nized likewise seems to have little foundation. To be sure, the passage in which the conversion is mentioned appears in an unusual place, but it is the unusual rather than the commonplace that attracts attention. An addendum to our paper contains the reference to his experiments.

Since this note is a presentation of our views on points raised by Marrian and Butenandt perhaps we may be accorded the privilege of commenting upon another phase of the matter.

At times we are mildly annoyed by the statements that are attributed to us by others writing on the follicular hormone. For example, both Laqueur⁵ and Butenandt⁶ state that we found a potency of 8,000,000 mouse units per gram of theelin. Actually, we have reported from 2,500-4,000 *rat units* per milligram and each investigator has converted these figures to mouse units, using such conversion factor as seemed most probable to him. Recently, we have for the first time assayed our crystalline theelin according to Butenandt's procedure (a single injection of a solution in sesame oil) and obtained a value much greater than 8,000,000 mouse units per gram.

As another example, both Marrian³ and Butenandt⁷ have stated that we gave to theelin the formula $C_{18}H_{23}O_2$, whereas what we actually stated in a brief preliminary note was: "Average, C 79.69 per cent; H 8.49 per cent; O 11.82 per cent. These data give an empirical formula of $C_{18}H_{23}O_2$ with a molecular weight of 271, which corresponds with the data of the table." Any organic chemist would know that either $C_{18}H_{22}O_2$ or $C_{18}H_{24}O_2$ is possible and more probable. Apparently the data were not recalculated or the wording of our statement would have been more apparent. Such corrections might be made *ad infinitum* if we allow our grievances to annoy us.

We have been both amazed and pleased with the investigations which seemed to have hinged at least in part upon the introduction of the vaginal smear bioassay procedure.⁸ Others being interested in the same general problem increases one's interest in his own work, and it has been a source of extreme gratification that so many investigators have become interested in the "ovarian hormone" problem.

The interests of the workers of this laboratory have been mainly chemical and we have endeavored to contribute our bit, at the same time recognizing the contributions of others. If the outstanding results of Marrian and Butenandt have not been adequately

recognized in our previous papers, we are sincerely regretful, since it is farthest from our desire to attain recognition by detracting from the works of others.

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STALACTITES AND STALAGMITES GROWING ABOVE GROUND

AN interesting occurrence of stalactities and stalagmites forming above ground has been noted by the writer. More than three hundred stalactites and a number of stalagmites, in all stages of development, are growing from the roof of a railroad bridge in the city of Wooster, Ohio.

The rain water which falls upon the bridge percolates through four feet of limestone ballast and a foot of cement before it finds its way through the joints between the steel plates to the ground below. The largest stalactite is twelve and one half inches long and about one half inch in diameter. There are many others more than six inches in length.

During the summer of 1919 the bridge was cleaned and painted. The stalactites are, therefore, not more than twelve years old. Where the water has dripped on the steel girders below a number of stalagmites have formed. Several of these are from an inch and one half to two and one half inches long. The solution is of high concentration and the rate of evaporation is high; consequently the stalactites are growing rapidly. Their great number affords an excellent opportunity to study them in all stages of development. In the near future the writer expects to publish the results of his observations.

KARL VER STEEG

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ENTOPTIC COLORS

THE entoptic colors described by Elmer F. Way as occurring during the operation of a motion picture projector at reduced speed, may perhaps be an instance of the phenomenon known as Fechner's colors. If a disk, partly black and partly white, be rotated slowly on a color wheel under bright illumination, a flickering play of colors appears on the surface. The proportions of black and white and the speed of rotation necessary to give the best results depend upon conditions, but a speed of two to five rotations per second is usually satisfactory.

This phenomenon is described by Charles S. Myers in his "Text-book of Experimental Psychology," part I, page 81.

VERNON W. LEMMON

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⁵ E. Dingemans, S. E. deJongh, S. Kober and E. Laqueur, *Deutsch. med. Woch.*, 56, 301, 1930.

⁶ A. Butenandt, *Zeit. f. physiol. Chem.*, 188, 1, 1930.

⁷ A. Butenandt, *Abhandlungen d. Gesellschaft d. Wissenschaften z. Göttingen*. III Folge, Heft 2, 1931.

⁸ E. Allen and E. A. Doisy, *J. Am. Med. Assn.*, 81, 819, 1923.

SCIENTIFIC BOOKS

Die Forstinsekten Mitteleuropas. Ein Lehr- und Handbuch, by K. ESCHERICH, Vol. III. pp. xi+725; figs. 608; 13 colored plates. Paul Parey, Berlin, 1931.

WHEN I first met Dr. Escherich (it was in 1906 in the big Forest School at Tharandt, Saxony) he told me that he was working on a revision of the fine work on the forest insects of middle Europe by Judeich and Nitsche. But Dr. Escherich was a very busy man, and, in 1911, spent several months in the United States traveling all over the country with me. On his return to Germany he wrote an admirable book on "Applied Entomology in the United States" and founded the German Society for Applied Entomology. It was not until 1913 that the first volume of this broadly planned work appeared. It was a well-illustrated volume of 432 pages and included a general consideration of insects, their morphology, anatomy and physiology, their development, their place in nature, their enemies and diseases, their outbreaks in disastrous numbers, the cultural means of avoiding damage and other general matters.

Then came the war, and Escherich was drawn into the military service of his country as a surgeon, and it was not until 1923 that the second volume was finished. I believe that I reviewed it in the columns of SCIENCE. It is a larger and very well-illustrated volume of 665 pages, and is devoted almost entirely to the Coleoptera, although there is a consideration of the less specialized orders. Naturally, the bark beetles are treated in much detail.

And now comes this magnificent third volume, which is devoted, as would be quite expected, almost wholly to the Lepidoptera—an order containing very many of the most destructive enemies of forest trees. And yet it is far from being simply a running account of or a detailed consideration of the species that thrive in Central Europe. It is the broadest kind of treatment. It goes into questions of morphology and anatomy, considers the damage done in general by this group, treats of them from the epidemiological point of view, and gives some space to the diseases of lepidopterous larvae. Since he has long studied the diseases of insects, he naturally gives some consideration to the different forms of these diseases, both those caused by bacteria and by microsporidia, and also naturally treats of the curious polyhedral diseases.

He displays rather fully the different systems of classification of this group, taking up consecutively the schemes of Boerner, Handlirsch, Hering, Heymons, Imms and Wolff and Krouwse. It is very interesting to see all these systems displayed by comparison, and it is also interesting to note that he gives Boerner's system precedence. The present

writer is greatly pleased to note the prominence given in most of these systems to the ideas of our own J. H. Comstock and to his classification based largely on wing venation; in fact there are many illustrations of the wing venations of many families in general.

In his introduction Escherich speaks of the rapidly broadening work carried on in this field since the publication (in 1923) of his second volume. This is especially marked in the taking up of Ecology as applied to general forest conditions, as well as to all the inhabitants. Not only during that period, but for a number of years before that time, the forest has been becoming more and more thought of as a whole, and this of course is the broadly scientific way to do it. Escherich has been a leader in this line of thought.

The writer then introduces a synoptic arrangement of insect damage by Lepidoptera, and then goes on to treat the larger groups and the species under them in a consecutive manner. The illustrations are very numerous and many of them are original. The 13 colored plates are of course all new and are very well done.

The first volume of this very great work was naturally dedicated to Heinrich Nitsche, and there is an excellent portrait of him as a frontispiece. The second volume is dedicated to J. T. C. Ratzeburg, who is referred to "des Altmeisters und Begründers der angewandten Entomologie." Escherich is quite right in referring to Ratzeburg as practically the founder of applied entomology in Germany so far as forest insects are concerned, but I think that future history will show or should show that Escherich himself is very largely, if not wholly, responsible for the great revival and broadening of the whole field in his country. Of course others took a part, notably Ludwig Reh, but since Escherich returned to Europe in the autumn of 1911 and published his book on "Applied Entomology in the United States" his appeal to the entomologists of Germany to found a society dealing with the practical aspects of the science met with an immediate response, and since then big things have been done over there. Some of the soundest and most usable papers are now coming from that country.

Since the present writer is not a forest entomologist and since his knowledge of the German language has failed him of later years, he realizes that this review is not a competent one and that his warm friend Escherich will be disappointed. Nevertheless, it is plain that "The Forest Insects of Middle Europe" is a great work, and that it has been done by a master.

L. O. HOWARD

PARIS,

NOVEMBER 13, 1931

SPECIAL CORRESPONDENCE

BRITISH COMMITTEE ON PETROGRAPHIC CLASSIFICATION

At the Centenary Meeting of the British Association for the Advancement of Science a committee was appointed to examine and report upon petrographic classification and nomenclature. Many outside the few appointed are interested in the problems that will be discussed, and the committee therefore invites readers of *SCIENCE* to forward their views to the secretary.

In the first place the committee is attempting to evaluate the data available for establishing a sound classification of igneous rocks, and invites replies to the following questionnaire:

(1) Do you agree that classification should be based upon ascertainable facts (*i.e.*, composition, both mineral and chemical, texture and geological occurrence, as distinct from hypotheses—of origin, etc.)?

(2) To what extent should the classification be based upon chemical composition as expressed in percentages of specific oxides?

(3) How far should the classification be based upon facts of geographical distribution, *i.e.*, upon the recognition of petrographical provinces?

(4) Are you in favor of the separation of igneous rocks into three divisions: plutonic, hypabyssal (dyke

rocks) and extrusive (lavas), following Rosenbusch and others; or into two divisions only, following Zirkel, Iddings and others?

(5) If in favor of three divisions, would you base the separation of the second from the third upon (a) texture or (b) actual geological occurrence?

(6) Should the naming of a rock be determined by the nature of the eruptive rocks with which it is associated? For example, trachybasalts (trachydolerites, Rosenbusch) are only distinguished from normal basalts by their occurrence with other alkali-rocks.

(7) In aiming at a complete classification for general acceptance by petrographers, are you in favor of retaining time-honored rock names, with meanings differing in many cases from those originally given to the names, or of introducing a new nomenclature?

(8) Do you think that the requirements of field geologists should be allowed to influence the classification and nomenclature of rocks, or should there be a simple classification with field-names for general use, and a more complete classification with more exact names for use in accurate petrography.

W. CAMPBELL SMITH,
Chairman.

A. K. WELLS,
Secretary.

UNIVERSITY OF LONDON

SCIENTIFIC APPARATUS AND LABORATORY METHODS

A SIMPLE DEVICE FOR ADDING LOAD AT A STEADY RATE

THE firmness or resistance to crushing of apples, pears and other fruits has been found to be a useful index of their maturity and suitability for harvest. To obtain this firmness in the form of a number mechanical devices are used. The time of harvest of green peas for canning is an extremely critical factor in the quality of the canned product and therefore an effort has been made at this station to devise a similar test for peas.¹ The spring balance used did not give the degree of precision desired, and the reading was visible for such a short time that it was likely to be misread.

In this work and in a similar test to determine the toughness of peas after canning² it has been thought to be necessary to add the load at a constant rate until the peas collapsed. To serve this purpose a

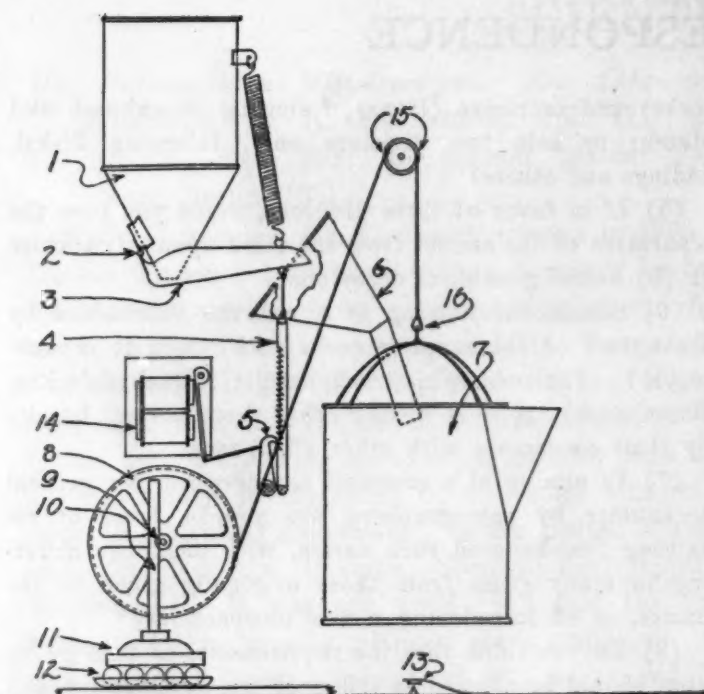
dispensing burette of glass filled with mercury has been recommended.² Obviously mercury is open to objections on account of its cost and toxicity, to which must be added the fact that it is a liquid and therefore will flow more rapidly at a given position of the glass stopcock when the burette is nearly full than when it is nearly empty.

The device illustrated has certain advantages for this test and any similar test where the application of a load at a constant and reproducible rate up to fifty pounds (25 kilos) is desired. It is not essentially new, since it resembles a common device for determining the tensile strength of Portland cement. It uses alternatively lead shot or any other round pellets, and depends upon the fact that the flow of these through an opening under their own weight is easily stopped.

As a reservoir for the shot a cylindrical container is provided with a bottom in the shape of a cone of preferably less than 60°. The tip of the cone is cut off by successive trials until the opening left is just

¹ N. Y. Agr. Exp. Sta. (Geneva) Tech. Bull., 176, 1931.

² U. S. Department of Agriculture Circular No. 164, 1931.



1, Reservoir for lead shot; 2, hinge; 3, movable pouring spout; 4, ratchet for holding spout at a given angle; 5, pawl to engage with ratchet bar 4; 6, guide funnel to direct shot into bucket 7; 7, detachable shot bucket; 8, grooved pulley; 9, pinion coaxial with pulley 7; 10, rack bar driven by pinion 9; 11, platen of glass which crushes peas; 12, receptacle for peas; 13, electrical contact for stopping shot at a predetermined position of the bucket; 14, electro-magnet which lifts pawl 5; 15, braided steel wire passing over pulley; 16, wire loop and hook for detaching bucket for weighing. It should be mentioned that parts 8, 9, 10, 11 and 12 are the essential parts of the device for determining the crushing value of peas described in N. Y. Agr. Exp. Sta. Tech. Bulletin 176, (Geneva) p. 12.

too large to be stopped up by the wedging of the shot or "bridging over." There is some latitude in its size, but it should be neither too large nor too small. One that has been found satisfactory for air rifle shot is 18 mm in diameter and will pass a dime but will retain a nickel.

Below the funnel a pouring spout is fastened by a hinge, so that shot passing through the funnel opening forms a pile upon its floor. This pile of shot grows until it surrounds the opening, whereupon the flow of shot from the reservoir is checked. If the inclination of the spout does not allow the shot to run out, the movement of shot from the reservoir stops instantly and completely. If the spout is tilted so that shot roll out the size of the pile is maintained from the reservoir, and a remarkably regular flow is kept up from the tip of the spout as long as there is any shot in the reservoir. A wide range of choice of rates of flow was found to be possible. The notches on the bar shown in the figure for holding the spout in any given position are 5 mm apart.

For an automatic cut-off the spout may be pulled back to the "off" position by the release of a spring. To prevent the violence of this motion from spilling some of the shot in the spout this is covered almost to the tip, and a suitably designed guide funnel is provided to direct all the shot that leaves the spout into the weighing bucket.

The drawing illustrates a device of this sort that was used with a previously described crushing tester for peas throughout an active season without requiring attention from the operator. The load reading is taken by detaching the bucket at leisure and weighing it upon a platform balance. It is emptied into the reservoir before attaching again and a pour-out is provided to make this more expeditious. It is not necessary to touch the shot with the hands.

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VOLTAGE-FREQUENCY RELATIONSHIPS IN ACTION CURRENTS

THE common method for studying action currents has been to record photographically their frequencies, amplitudes and phase angles. It has yielded noteworthy results. However, certain questions have arisen not only in regard to the interpretation but also in connection with the reading of such recordings. The most of us have read the time interval between successive peaks in the wave train in order to obtain the frequency. This method is both inaccurate and inadequate. Granted that pictorially all the fundamental frequencies and their harmonic contents are present there is no known method for reading a non-repeating electrical wave such as we have represented in the action currents of nerve and muscle. In the vast majority of our action current records we could not fit even approximately a Fourier Series which proceeds by sines or cosines or multiples of a variable.

There is a method which overcomes, partially at least, the difficulties confronting us in a wave analysis of action currents. It amounts to determining what proportion of the total voltage generated lies within a certain frequency band. The frequency-intensity-phase angle relationships are thus resolved into a common denominator, voltage which for practical purposes may be thought of as power. Power equals the voltage squared divided by resistance and as we may hold the latter constant the voltage may be read as a direct expression of power. This unit of analysis is not only accurate but practical.

We have used two three-stage amplifiers, one of the resistance and the other of the impedance coupled type, a filter circuit and an alternating current volt-

meter to study voltage-frequency relationships in action currents (Fig. 1). The overall frequency

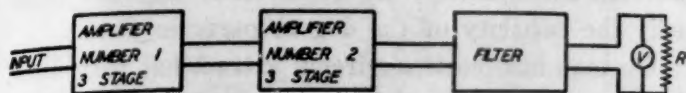


FIG. 1. A diagrammatic sketch of the voltage-frequency measuring unit.

deflection characteristic of the two amplifiers was linear between 100 and 6,000 cycles per second. The voltmeter had no frequency discrimination between 80 and 5,000 cycles per second. All the commonly studied muscles of the human body have been scouted in this preliminary report. The subject was asked to tense the muscles from which action currents were being led off until a full-scale deflection of 9 volts was obtained on the voltmeter. Then as each filter circuit was introduced the new reduced voltmeter deflection was noted. Thus it was possible to determine what proportion of the voltage generated by the contracting muscles was within the frequency range being passed by the filter circuit.

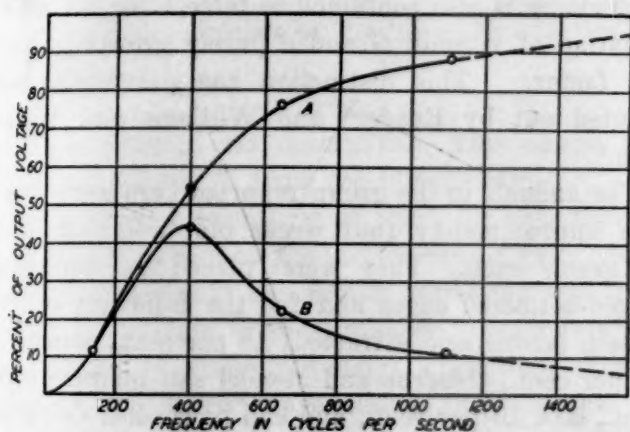


FIG. 2. Voltage-frequency curves for action currents from the tongue.

Curve B of Fig 2 shows the proportion of the total action current voltage in a given action current frequency band.¹ Several features of this curve strike our attention. Its general shape resembles that of a probability curve. The largest percentage of the voltage (44 per cent.) is expressed at 400 cycles per second and half of the total voltage generated falls between 130 and 450 cycles per second. This may be taken to mean that a large portion of the fundamental frequency is in the neighborhood of 400 cycles and that the second harmonic is an appreciable portion of the fundamental. Eleven per cent. of the voltage is above 1,100 cycles per second.

Curve A of Fig. 2 is an accumulative curve which shows what percentage of the total action current voltage may be expected to fall above or below a given action current frequency.

From these curves we may assume that the action current wave is a very complex one. It is indicative probably of direct, pulsating direct and alternating currents which may not have direct relationships with each other in respect to phase or time. The action current waves may not present harmonics. Rather they may be composed of fundamental, pure sine waves which are generated more or less crazily by the extremely complicated electrical generating network. If this is true then we should be able to isolate certain generating points by means of a system of filters having very narrow band widths.

It remains to test this method in a wide variety of problems in electrophysiology.

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SPECIAL ARTICLES

THE EFFECT OF CORTICO-ADRENAL EXTRACT ON ENERGY OUTPUT¹

THE effect of extracts of the adrenal gland on the activity of muscle has been reported by many observers;² it is to be noted that attention has been directed primarily, however, to the action of epinephrine. More recently workers have reported on the effects produced by extracts of the adrenal cortex.³ These investigations were in all cases carried out with nerve-muscle preparations. The intact, normal animal

¹ Reported in brief at the joint session of the Federation of American Societies for Experimental Biology, Montreal, Canada, April 11, 1931.

² M. Yoshimoto, *Quart. Jour. Exp. Physiol.*, 13: 5, 1922.

³ A. Obré, *Compt. rend. soc. biol.*, 88: 585, 1923; J. Steff, *ibid.*, 99: 985, 1928; F. de Mira and J. Fontes, *ibid.*, 98: 987, 1928; and 100: 602, 1929.

has not hitherto been used to demonstrate the effect of cortico-adrenal extract on the capacity to perform work. The substances used, furthermore, were of doubtful potency.

Dogs have been trained in this laboratory to run in a treadmill, and their total energy output in excess of basal metabolism has been determined in a series of experiments. The action of cortico-adrenal extract, prepared as previously described⁴ according to the method of Swingle and Pfiffner,⁵ and proved to be

¹ Filter transmission characteristics were known and evaluated.

⁴ S. W. Britton and H. Silvette, *SCIENCE*, 73: 322, March 20, 1931; *ibid.*, 373, April 3, 1931; *Amer. Jour. Physiol.*, 99: 15, 1931.

⁵ W. W. Swingle and J. J. Pfiffner, *Amer. Jour. Physiol.*, 96: 153, 1931.

effective on adrenalectomized cats, was then tested. The material was injected intraperitoneally, and the subsequent effects on the ability to work were ascertained.

The working capacity of a normal (uninjected) dog is affected by training. It increases rapidly at first, but later it varies only slightly from the "standard output." Pulse rates increased from between 80 to 104 per minute during rest, to between 118 and 144 per minute at the end of a severe bout of exercise. The rates returned to normal within 20 to 40 minutes after the conclusion of an experiment. During the early stages of training the pulse rates were somewhat higher than those observed after a number of experiments had been carried out. The blood-sugar level in the normal dog showed a tendency to decrease during long-continued work, and to increase during the subsequent rest period. There was no close correlation between the glycemic level and the condition of the dog after exercise.

Injection of extract brought about a slight rise in the blood sugar of the resting, unexercised animal. The glycemic level was higher during experiments when the animal was under the influence of extract than when the effect of the extract was disappearing. Intraperitoneal injection of cortico-adrenal extract considerably increased the energy output. The extract was slowly acting in this respect, and exerted its maximum effect usually within 5 to 10 days. In one case, 20 cc of extract given intraperitoneally brought about a gradual increase in the total energy output in excess of basal metabolism. The increase reached a maximum of 115 per cent. in 10 days; thereafter a gradual decline in energy output was observed, and the previously established normal was eventually attained.

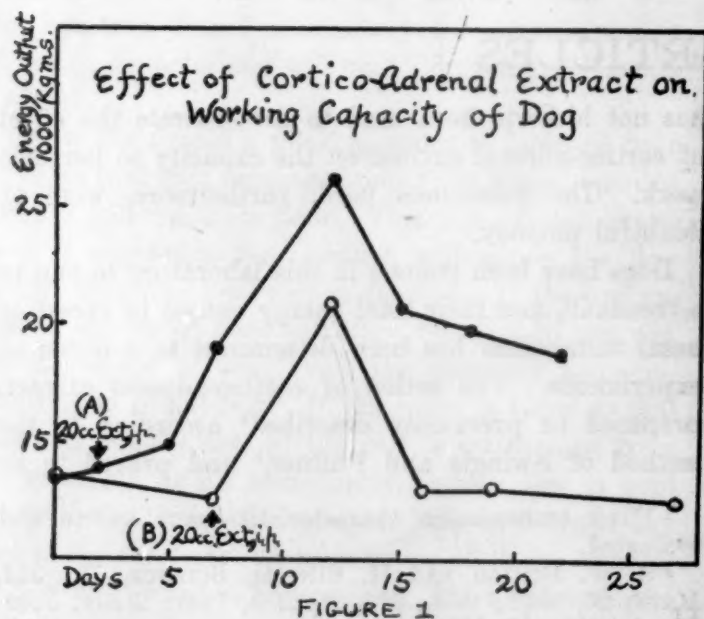


Fig. 1 shows graphically the effect of the extract on the energy output in excess of basal metabolism

in two groups of experiments. Extracts of the adrenal cortex, of proven potency in overcoming adrenal insufficiency, are observed to augment markedly the capacity of the dog to perform work.

On man also cortico-adrenal extract has been found by ergographic record to increase notably the ability to carry out muscular exercise.

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VITAMIN G AND THE GROWTH FACTOR IN TOMATO JUICE

DURING the course of some vitamin assay determinations on canned tomato juice, we obtained evidence to show the lack of vitamin G (B_2) in either canned or fresh whole tomato juice. This is in disagreement with the findings of Goldberger and his associates^{1, 2} and Hartley,³ if we accept the statement that pellagra, black-tongue and dermatitis are all caused by the lack of vitamin G.

Evidence is also contained in table I for the differentiation of vitamin G and a purely growth-promoting factor. This distinction has previously been pointed out by Reader⁴ and Williams and Waterman.⁵

The animals in the group reported here were young rats approximately four weeks old, weighing 30 to 40 grams each. They were placed in individual screen-bottomed cages and fed the following ration: Casein (acetic acid extracted) 18 per cent., cornstarch 66 per cent., Osborne and Mendel salt mixture 4 per cent., lard 10 per cent., and cod liver oil 2 drops per rat daily. After one week of depletion on the basal ration devoid of all factors of the B complex, constant weights were obtained. Graded doses of tomato juice, as indicated in the table, were then fed daily in separate cups for an eight weeks' period. Weights of the animals were recorded daily as well as symptoms of deficiency.

In the groups that lived long enough to develop a dermatitis, it always appeared in approximately 44 days, regardless of the amount of tomato juice fed. That the dermatitis shown by these rats was of nutritional origin, and not of epidemic nature, is indicated by the fact that they were kept on the same racks as some rats used in vitamin A assay experiments, and

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¹ Goldberger, Wheeler, Lillie and Rogers, U. S. Public Health Reports, 42: 1299, 1927.

² Goldberger and Wheeler, U. S. Public Health Reports, 43: 1385, 1928.

³ Hartley, 1930 (personal communication to Sherman and Smith), "The Vitamins," p. 139, 1931.

⁴ Reader, *Biochem. J.*, 24: 1827, 1930.

⁵ Williams and Waterman, *J. Biol. Chem.*, 78: 311, 1928.

TABLE I

Dose	No. rats in group	Days lived. Average	Polynuritis ¹ developed on day. Average	Dermatitis developed on day. Average	Average gain 8 weeks
Neg. controls	5	23	13.4	None	- 12.4
3 cc fresh juice	7	46	28.8	None	- 9.86
3 cc canned " "	7	45.8	27.1	None	- 11.0
4 cc fresh " "	7	50.28	44.1	43.57	- 11.0
4 cc canned " "	7	54.9	51.85	43.4	- 4.14
5 cc fresh " "	7	56 + ²	51.1	43.1	- 1.8
5 cc canned " "	7	56 +	53.16	45.16	+ 12.7
6 cc fresh " "	7	56 +	55.0	44.1	+ 1.3
6 cc canned " "	7	56 +	56 +	44.7	+ 11.0
7 cc fresh " "	7	56 +	56 +	43.5	+ 5.1
7 cc canned " "	7	56 +	56 +	43.0	+ 10.3
Average 43.8					

Autopsies in all cases confirmed the symptoms shown.

¹ Severe type.

² 56 + indicates animals still alive at termination of experiment.

³ Beechnut Brand.

these rats showed no dermatitis. This shows the absence of vitamin G from the tomato juice.

On the smaller quantities of juice, the rats showed a loss of weight and on the larger doses a gain. It is shown that this gain can not be correlated with any presence of vitamin G and probably is not related to the presence of vitamin B (B_1) since Reader⁴ and Williams and Lewis⁵ have shown the absence of growth when rats were fed an abundance of this vitamin. This growth factor, therefore, probably is Reader's B_4 or the vitamin F, of which Sure, Smith and Kik⁷ speak.

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ARE LEAF LIPIDES RESPONSIVE TO SOLAR RADIATION?¹

EXPERIENCE reported elsewhere² led to the present inquiry. The earlier work had shown a consistent increase of lipid content in various plant species reared under Vita glass in comparison with common glass. Vita glass is one of the several products which transmits greater proportions of both ultra-violet and infra-

red radiations than does common glass. Additional evidence of favorable rôles of this glass has been obtained which can not be presented in detail here. Livingston Globe tomato plants transplanted to the field from beneath Vita glass have yielded an earlier and larger crop than plants simultaneously transferred from common glass; and Early Fortune cucumber plants have developed more rapidly under Vita glass than under common glass in the early spring, ultimately producing larger fruits in the greenhouse. In these cases the air temperature was maintained essentially equal under the two forms of glass by use of a fan. Inasmuch as the tomato (*Lycopersicon esculentum*) had responded prominently in the manner indicated above, it was subjected to special examination of the lipid fraction.

A large quantity of leaf tissue was taken from potted plants of the Bonnie Best variety late in February. The height under common glass at this time was about 30 cm, while development had recently been noticeably more rapid under Vita glass.

Hot alcoholic extraction of 740 gm leaf tissue, as free from petioles as feasible, yielded about 12 gm of crude lipides. Determinations on separate samples of leaf blade tissue³ indicated the presence of 1.76 per cent. chlorophylls (as potassium chlorophyllins) 0.007 per cent. carotin, and 0.053 per cent. xanthophylls in the dry tissue beneath common glass; with 1.50, 0.017 and 0.068 as the corresponding percentages under Vita glass. From the partially purified lipides precipitation of the sterols was effected as digitonides after saponification. In this form they amounted to 0.81 per cent. of the dry tissue under common glass and 0.87 under Vita glass. It is probable that alcohols of high molecular weight other than sterols and fatty acids associated with both in waxes were present, but these possibilities have not yet been investigated.

While the values here found for leaf pigments may be considered abnormal it must be recognized that the conditions of illumination, in relation to the requirements of this species, were also abnormal at the date of sampling, and had been more so during midwinter. It appears that the plane of carotinoids, and to a less extent that of sterols, has been favored by the increased radiation under Vita glass, with a corresponding decline in the content of chlorophylls. To be sure, the percentage fluctuations in lipid components here observed are of small magnitude. Their possible import would become more apparent were they converted to actual weights of constituents in equal numbers of plants under the two forms of glass. No record of plant yields were taken in this instance, but our earlier records, already mentioned, show

³ With the aid of E. R. Tobey, graduate student.

⁴ Williams and Lewis, *J. Biol. Chem.*, 89: 275, 1930.

⁵ Sure, Smith and Kik, *SCIENCE*, 73: 242, 1931.

¹ Published with the approval of the director of the Wisconsin Agricultural Experiment Station.

² W. E. Tottingham and J. G. Moore, "Some Phases of Plant Development under Vita Glass," *Jour. Agric. Research*, 43: 133-163, 1931.

marked increase in tissue production by the tomato under Vita glass. In view of the rôle of lipides, and particularly their fatty acid and sterol components, as carriers of energy, even small variations within this compositional fraction of plant tissue merit attention. Yet variation of its proportions in tissue might bear little relation to the potency of a growth promoting factor. One must admit that such a factor might either induce a growth rate parallel to its own accumulation or become activated to a special function without increase in amount. In the former case there would be no difference in percentage of the compound concerned as radiation treatment varied, while in the latter case it would decline in proportion as the tissue developed. In the present instance the increased content of carotinoids and sterols is merely suggestive of a causal relation of these lipides to increased vegetative development.

The observations here briefly presented increase the desirability of further investigation of the influences of solar radiation in plant growth. As suggested in our earlier paper, it will be desirable to isolate the effects of ultra-violet from those of infra-red radiations, as may be accomplished by the use of a water cell to absorb the latter spectral region.

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EFFECT OF DISSOLVED CO₂ ON THE pH OF WATER

THE recent letter in SCIENCE by Mr. Emil Truog concerning the hydrogen-ion concentration of water in which carbon dioxide is dissolved, prompts me to present the following calculations which were made several years ago in connection with some calculations on the lead carbonate equilibrium, and which, I think, have not appeared elsewhere.

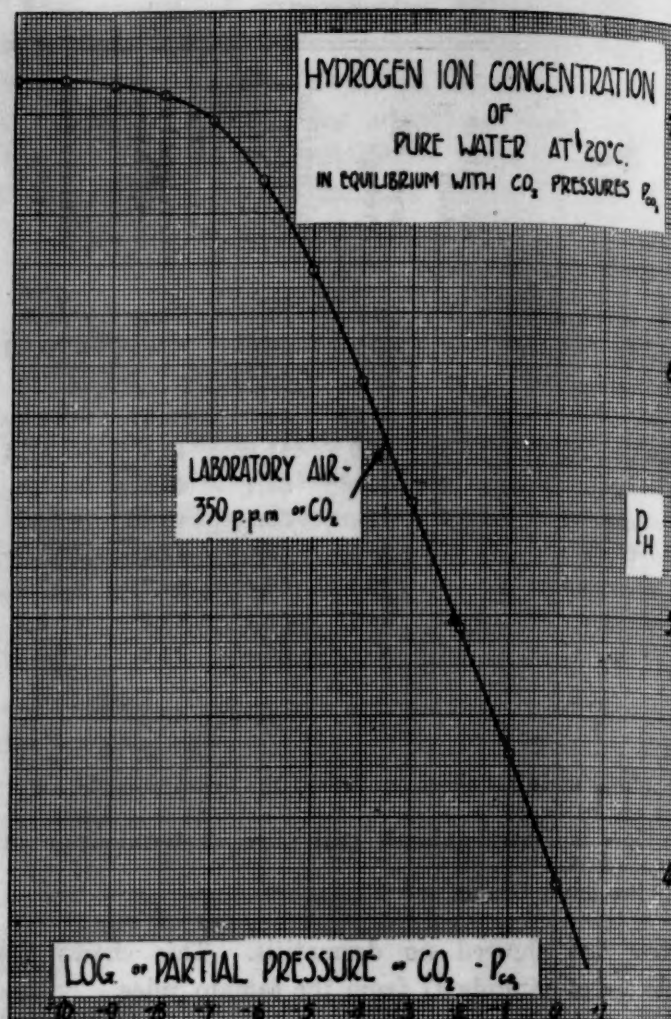
Setting up the familiar equations of carbonate equilibria with values of the constants indicated,

- (1) $[H^+][OH'] = K_w = 0.54 \times 10^{-14}$ (20° C.)
- (2) $[H^+][HCO_3']/[H_2CO_3] = k_1 = 3.18 \times 10^{-7}$ (20°)
- (3) $[H^+][CO_3'']/[HCO_3'] = k_2 = 3.54 \times 10^{-11}$ (20°)
- (4) $[H_2CO_3] = ncP$ $nc = .0393$ (20°)
- (4) $[H_2CO_3] = ncP$ $nc = .0393$ (20°)
- (5) $[H^+] = 2[CO_3''] + [HCO_3'] + [OH']$

we arrive at the following equation containing only constants and the two unknowns, $[H^+]$ and P

$$(6) [H^+] = \frac{2k_1 k_2 ncP}{[H^+]^2} + \frac{k_1 ncP}{[H^+]} + \frac{K_w}{[H^+]}$$

This equation (6) is solved for $[H^+]$ by substituting values of P , the partial pressure of CO₂ with which the pure water is in equilibrium.



The curve of pH plotted against log of the partial pressure of CO₂ is practically linear from one atmosphere of CO₂ to about 10⁻⁶ atmospheres (which includes the range usually encountered) and for a pressure of CO₂, corresponding to 350 parts per million in air—an average value—gives a calculated pH of 5.68 which agrees well with the value given by Truog. From 10⁻⁶ of an atmosphere of CO₂ to zero pressure of CO₂, the curve rapidly approaches the dissociation constant of pure water as asymptote. The curve shows these results graphically.

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